September 2010

Sections 53, 54, 55 and 56
Ontario Water Resources Act
R.S.O. 1990

Sample Application Package

for a Certificate of Approval (Sewage Works)

for a Municipal Wastewater Treatment Plant

Veuillez noter que ce document n'est disponible qu'en anglais

PIBS 7850e

Protecting our environment. Ontario

Introduction:

This document has been created as an example of a complete Application for Approval for a Certificate of Approval (Municipal Sewage Works). The municipal wastewater treatment plant (Acme Wastewater Treatment Plant) is used as an illustration and does not exist. Any resemblance to real people, places or events is coincidental and unintended.

This example includes samples of several forms that are required to be completed and submitted when applying for a Municipal Sewage Works Certificate of Approval. To obtain a copy of these documents, please refer to the "publications" section of the Ministry of the Environment Internet site at www.ene.gov.on.ca or contact the Environmental Assessment and Approvals Branch by telephone at 1-800-461-6290 (locally at 416-314-8001) or by email at EAABGen@ene.gov.on.ca.

Forms used in this sample application:

PIBS #	Title
7340	Application for a Approval of Sewage Works
4107	Costs for OWRA s.53 Applications - Supplement to Application for Approval
6238	Pipe data form: Water Main, storm sewer, sanitary sewer, and forcemain Design. Supplement to application for approval for water and sewage works.

Cette publication hautement spécialisée n'est disponible qu'en anglais en vertu du Règlement 411/97 qui en exempte l'application de la Loi sur les services en français. Pour obtenir de l'aide en français, veuillez communiquer avec le Direction des évaluations et des autorisations environnementales au ministère de l'Environnement au 416-314-8001 (sans frais : 1-800-461-6290).

CONSULTING LTD.

123 Office Drive, Someplace, ON A1B 2C3
Telephone: 123-555-1234
Fax: 123-555-5678

September 21, 2009

Ministry of the Environment
Environmental Assessment and Approvals Branch (EAAB)
2 St. Clair Avenue West, Floor 12A
Toronto, Ontario
M4V 1L5

Attention: Director, EAAB

Dear Director:

Re: Application for Certificate of Approval (Municipal Sewage Works)
ACME Wastewater Treatment Plant
Anytown, Ontario

On behalf of the City of Anytown (the City), this application is being made under Section 53 of the Ontario Water Resources Act (OWRA) for the proposed upgrade and expansion of the ACME Wastewater Treatment Plant (WWTP) located in the City of Anytown.

The capacity of the existing ACME WWTP is 1,205 m^3/d, and the current average daily flow to the plant is nearing capacity. Consulting Ltd. was retained by the City to develop a detailed design for the expansion of the plant to a capacity of 2,874 m^3/d to address anticipated population growth in the area. Included in the proposed upgrade and expansion are:

- addition of a pump to the existing influent pumping station;
- a new secondary treatment system to run parallel to the existing plant;
- a new tertiary treatment system to replace the existing tertiary treatment system;
- expansion and relocation of the existing UV disinfection system;
- a new sludge handling system including gravity sludge thickeners, a sludge holding tank and new sludge transfer station;
- an odour control system; and
- associated structures, instrumentation, electrical and other facilities to support the aforementioned components.

The WWTP is currently approved under Certificate 1234-567A8B issued on December 15, 1993. This application seeks an amendment to Certificate 1234-567A8B to include the features of the proposed upgrade and expansion.

Attached to this cover letter are the completed application forms including the required fee and various supporting documentation for the above requested approval.

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September 21, 2009

One (1) copy of the application is being submitted to the Environmental Assessment and Approvals Branch of the Ministry of the Environment, and one (1) copy is being submitted to the Othertown District Office of MOE. Mr. Bill Representative of the Othertown District Office has been consulted previously regarding this project.

Should there be questions on any aspect of this submission, please do not hesitate to contact the undersigned.

Yours truly,

Jo Consultant

Jo Consultant, P.Eng.
Project Manager, Consulting Ltd.

JC/cg/1
Encl.

c.c.: Bill Representative, District Manager, MOE Othertown District Office
John Operations, Project Manager, City of Anytown

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September 21, 2009

ATTACHMENTS

- Application for Approval of Municipal and Private Sewage Works (PIBS 4063e01)

Attachment 1: Costs for OWRA s. 53 Applications, Supplement to Application for Approval (PIBS 4107)

Attachment 2: Summary of Pre-Application Consultation

Attachment 3: Legal Survey

Attachment 4: Existing Certificate of Approval No. 1234-567A8B

Attachment 5: Environmental Study Report (Attached separately)

Attachment 6: Addendum to Environmental Study Report (Attached separately)

Attachment 7: Letter of Confirmation - Class Environmental Assessment

Attachment 8: Letter of Acceptance – Effluent Criteria

Attachment 9: Design Brief (Attached separately)

Attachment 10: Engineering Design Drawings and Specifications (Attached separately)

Attachment 11: MOE Pipe Data Form, Watermain, Storm Sewer, Sanitary Sewer and Forcemain Design, Supplement to Application for Approval for Water and Sewage Works (PIBS 6238e)

Attachment 12: Description of Proposed Works

Attachment 13: Proof of Source Water Protection Consultation

Ontario

Ministry of the Environment

Ce formulaire est disponible en français

Application for Approval of Municipal and Private Sewage Works

For Office Use Only			
Reference Number	Payment Received	Date *(y/m/d)*	Initials
	$		

General Information and Instructions

General:

Information requested in this form is collected under the authority of the *Ontario Water Resources Act*, R.S.O. 1990 (OWRA) and the *Environmental Bill of Rights*, C. 28, Statues of Ontario, 1993, (EBR) and will be used to evaluate applications for approval of municipal and private sewage works as required by Section 53 (OWRA).

Instructions:

1. When completing this form, please refer to the "Guide for Applying for Approval of Municipal and Private Water and Sewage Works, Sections 52 and 53, OWRA" (referred to as the Guide) and "Guide - Application Cost for Sewage Works, S. 53, OWRA." Questions regarding completion and submission of the application should be directed to the Environmental Assessment & Approvals Branch, 2 St. Clair Avenue West, Floor 12A, Toronto, Ontario, M4V 1L5, telephone number 1-800-461-6290 or (416)314-8001, or to your local District Office of the Ministry of the Environment.

2. This form must be completed with respect to all the requirements of the Guide in order for it to be considered as an application for approval. INCOMPLETE APPLICATIONS WILL BE RETURNED TO THE APPLICANT.

3. A complete application consists of:
   (1) a completed and signed application form, including the attached "Costs for OWRA, S. 53 Application Fees - Supplement to Application for Approval";
   (2) all required supporting information identified in this form and the Guide, and
   (3) a certified cheque or money order, in Canadian funds, made payable to the *Minister of Finance* for the applicable application fee.
   The Ministry may require additional information during the technical review of any application accepted as complete.

4. The original application, along with the supporting information and the application fee, must be sent to:
   The Ministry of the Environment,
   Director, Environmental Assessment and Approvals Branch,
   2 St. Clair Avenue West, Floor 12A, Toronto, Ontario M4V 1L5.
   A copy of the application and the supporting information must be sent to the local Ministry District Office which has jurisdiction over the area where the works are located.

5. Information contained in this application is not considered confidential and will be made available to the public upon request. Information submitted as supporting information may be claimed as confidential but will be subject to the *Freedom of Information and Protection of Privacy Act* (FOIPPA) and *EBR*. If you do not claim confidentiality at the time of submitting the information, the Ministry may make the information available to the public without further notice to you.

6. If the Client submits with the application a copy of their Master Business Licence (MBL) obtained from the Ministry of Consumer and Commercial Relations, the **shaded sections within this form do not need to be completed**. For additional information on the MBL please refer to the "Guide."

1. Client Information *(Owner of works/facility)*

Client Name *(legal name of individual or organization as evidenced by legal documents)*	Business Identification Number
City of Anytown	

Business Name *(the name under which the entity is operating or trading if different from the Client Name - also referred to as trade name)*

Client Type:

- ☐ Corporation
- ☐ Individual
- ☐ Partnership
- ☐ Sole Proprietor
- ☐ Federal Government
- ☒ Municipal Government
- ☐ Provincial Government
- ☐ Other *(describe)*:

Activity Classification Code/Standard Industrial Classification Code *(if unknown please complete Business Activity Description)*: 221310

Business Activity Description *(a narrative description of the business endeavour, this may include products sold, services provided or machinery/equipment used, etc.)*

Municipal wastewater treatment (ACME Wastewater Treatment Plant [WWTP])

2. Client Physical Address - *Complete A, C and D* **or** *B, C and D*

A. Civic Address- Street information *(applies to an address that has civic numbering and street information includes street number, name, type and direction)*	Unit Identifier *(identifies type of unit, such as suite & number)*
321 Avenue Rd.	

B. Survey Address *(used for a rural location specified for a subdivided township, an unsubdivided township or unsurveyed territory)*

Lot and Conc.: used to indicate location within a subdivided township and consists of a lot number and a concession number.	Lot	Conc.	Part and Reference: used to indicate location within an unsubdivided township or unsurveyed territory, and consists of a part and a reference plan number indicating the location within that plan. Attach copy of the plan.	Part	Reference Plan

C. Municipality/Unorganized Township	County/District	Province/State	Country	Postal Code
Anytown		ON	Canada	C3B 2A1

D. Telephone Number *(including area code & extension)*	Fax Number *(including area code)*	E-mail Address
123-555-1357	123-555-2468	joperations@anytown.on.ca

3. Client Mailing Address - *Complete A and C* **or** *B and C*

A. Civic Address - Street information *(includes street number, name, type and direction)*	☒ Same as Client Physical Address	Unit Identifier *(identifies type of unit, such as suite & number)*

B. Delivery Designator: ☐ Rural Route ☐ Suburban Service ☐ Mobile Route ☐ General Delivery	Delivery Identifier *(a number identifying a Rural Route, Suburban Service or Mobile Route delivery mode)*

C. Municipality	Postal Station	Province/State	Country	Postal Code

4. Site Information - *(location where activity/works applied for is to take place)*

Site Name	MOE District Office	Legal Description *(attach copy of a legal survey)*
ACME WWTP	Othertown	Legal survey is attached.

A. Site Address - Street information *(applies to an address that has civic numbering and street information - includes street number, name, type and direction)*	☐ Same as Client Physical Address	Unit Identifier *(identifies type of unit, such as suite & number)*
1098 Boulevard Rd.		

B. Survey Address *(used for a rural location specified for a subdivided township, an unsubdivided township or unsurveyed territory) NOTE:* Do not complete "B" if you completed "A."

Lot and Conc.: used to indicate location within a subdivided township and consists of a lot number and a concession number.	Lot	Conc.	Part and Reference: used to indicate location within an unsubdivided township or unsurveyed territory, and consists of a part and a reference plan number indicating the location within that plan. Attach copy of the plan.	Part	Reference Plan

Non Address Information *(includes any additional information to clarify clients' physical location)*

Geo Reference

Map Datum	Zone	Accuracy Estimate	Geo Referencing Method	UTM Easting	UTM Northing
NAD83	17	+/- 10 m	GPS	XXXXX	XXXXX

Municipality/Unorganized Township	County/District	Postal Code
Anytown		D4E 5F6

Adjacent Land Use

☐ Industrial ☐ Commercial ☐ Recreational
☒ Residential ☐ Agricultural ☐ Other *(specify)*: _____

Is the Site located in an area of development control as defined by the Niagara Escarpment Planning & Development Act (NEPDA)?

☐ Yes (If Yes, attach copy of NEPDA permit for the proposed activity/work) ☒ No

Is the Client the operating authority? ☒ Yes ☐ No

If No, attach the operating authority name, address and phone number.

Is the Client the owner of the land (site)? ☒ Yes ☐ No

If No, attach the owner's name, address and consent for the installation and operation of the facilities.

Is the Site located on the Oak Ridges Moraine Conservation Area as defined by the Oak Ridges Moraine Conservation Plan (ORMCP, a regulation made under the Oak Ridges Moraine Conservation Act (ORMCA)?

☐ Yes **(If yes please attach proof of Municipal planning approval for the proposed activity/work)**

☒ No

5. Project Technical Information Contact - *Complete A, B, D and E* **or** *A, C, D, and E*

A. Name	Company	☐ Same as Client Name
Jo Consultant, P.Eng.	Consulting Ltd.	

Contact Address ☐ Same as Client Mailing Address — Unit Identifier *(identifies type of unit, such as suite & number)*

B. Civic Address - Street information *(includes street number, name, type and direction)*: 123 Office Dr.

C. Delivery Designator: ☐ Rural Route ☐ Suburban Service ☐ Mobile Route ☐ General Delivery — Delivery Identifier *(a number identifying a Rural Route, Suburban Service or Mobile Route delivery mode)*

D. Municipality	Postal Station	Province/State	Country	Postal Code
Someplace		ON	Canada	A1B 2C3

E. Telephone Number *(including area code & extension)*	Fax Number *(including area code)*	E-mail Address
123-555-1234	123-555-5678	jconsultant@consulting.ca

6. Project Information

Type of Application:
- ☐ New Certificate of Approval
- ☒ Amendment to current Certificate of Approval

Current Certificate of Approval Number: 1234-567A8B — Date of Issue *(y/m/d)*: 1993/12/15

Transfer of Review: ☐ Yes ☒ No

Has a completed Pipe Data Form been included with this application? ☒ Yes ☐ No *If sanitary and/or storm sewers are part of the proposed works, Pipe Data Form is required.*

Project Description Summary *(If EBR is applicable, this summary will be used in the EBR posting notice)*

The City of Anytown (City) identified a need for increased capacity at the ACME WWTP to accommodate population growth in the service area. A Class Environmental Assessment (EA) completed in 1997 recommended expansion of the Boulevard Road Pumping Station (PS) and the ACME WWTP to a rated capacity of 2,874 m3/d and identified the preferred approach to the expansion project. The 10-year Class EA approval period expired in 2007. In 2008 Consulting Ltd. prepared an ESR Addendum, which verified that the project approach and mitigation measures identified in the original ESR remain valid. Consulting Ltd. was retained by the City to provide detailed design services for the expansion project. Included in the proposed expansion are: the installation of a third lift pump at the Boulevard Road PS, a new secondary treatment system to run parallel to the existing system, a new dual-stage tertiary sand filtration system, relocation and expansion of the existing UV disinfection system, a new sludge handling system (including gravity sludge thickeners and an aerated sludge holding tank), an odour control system, and upgrade of the plant outfall.

Project Name *(Project identifier to be used as a reference in correspondence)*	Receiver of Effluent Discharge	Watershed Name
ACME WWTP Expansion	Anytown River	Anytown River Valley

Project Schedule

Estimated date for start of construction/installation	Estimated date for start of operation
April 2010	April 2011

7. Other Approvals / Permits

List all other environmental approvals/permits applied for related to this project or received in relation to this project under the *Environmental Protection Act* (discharges to air, waste management, etc.) and the *Ontario Water Resources Act* (water works).

C of A (Air & Noise) - odour control unit and standby generators, MOE Permit to Take Water

8. Public Consultation/Notification

Specify all public consultation/notification *(such as public hearings, notification of First Nations, etc.)* related to the project that has been completed or is in the process of being completed.

See Environmental Study Report and Environmental Study Report Addendum.

9. Environmental Bill of Rights Requirements

Is this a proposal for a Prescribed instrument under EBR?	If "Yes," is it excepted from public participation?	If it is excepted from public participation provide reason:	
☐ Yes ☒ No	☐ Yes ☐ No	☐ Equivalent Public Participation	☐ Environmentally Insignificant Amendment or Revocation
		☐ Emergency	☐ EAA or Tribunal Decision
Documentation is support of the above noted exception must be provided (refer to "Guide")			

10. Environmental Assessment Act (EAA) Requirements

☐ The works for which this application is made have fulfilled all requirements of the EAA through the completion of:

Class Ea for Municipal Water and Wastewater Project has been completed in accordance with the procedure set out in:

☐ Schedule A ☐ Schedule B ☒ Schedule C

☐ The works are exempt from requirements of the EAA under:

☐ Section of the Ontario Regulation No. ☐ Exemption Order

If Regulation or Exemption Order does not refer directly to these works, state in covering letter or other document why it does apply to the works.

☐ The works are proceeding in accordance with the Environmental Assessment Process Approval Notice specified below:

☐ The works are not subject to EAA for the reason specified below:

11. Supporting Information Checklist - *This is a list of all supporting information to this application and is subject to the FOIPPA and EBR.*

Supporting Information	Attached		Reference	Can be disclosed	
General					
Pre-application consultation record	☒ Yes	☐ No	Attachment 2	☐ Yes	☐ No
Proof of Legal Name of Client	☐ Yes	☒ No		☐ Yes	☐ No
Copy of NEPDA Permit	☐ Yes	☒ No		☐ Yes	☐ No
Name, Address and Phone Number of the Operating Authority	☒ Yes	☐ No	See Section 2	☐ Yes	☐ No
Name, Address and consent of land/site owner for the installation/construction and operation of the works/facility	☒ Yes	☐ No	See Section 2	☐ Yes	☐ No
Documentation in support of EBR Public Participation Exception	☐ Yes	☒ No		☐ Yes	☐ No
Proof of Public Consultation/Notification	☒ Yes	☐ No	See ESR (Attachment 5), and ESR Addendum (Attachment 6)	☐ Yes	☐ No
Financial Assurance	☐ Yes	☒ No		☐ Yes	☐ No
Technical					
Detailed Description of the Proposed Works	☒ Yes	☐ No	Attachment 12	☐ Yes	☐ No
Environmental Study Report (ESR)	☒ Yes	☐ No	Attachment 5 (and Addendum, Attachment 6)	☐ Yes	☐ No
Preliminary Engineering Report	☐ Yes	☒ No		☐ Yes	☐ No
Site Plan	☒ Yes	☐ No	See Design Drawings (Attachment 10)	☐ Yes	☐ No
Design Brief/Report	☒ Yes	☐ No	Attachment 9	☐ Yes	☐ No
Hydraulic and Process Calculations	☒ Yes	☐ No	See Design Bnef (Attachment 9)	☐ Yes	☐ No
Final plans and Specifications	☒ Yes	☐ No	Attachment 10	☐ Yes	☐ No
Influent Sewage Quantity and Quality Characteristics	☒ Yes	☐ No	See Design Brief (Attachment 9)	☐ Yes	☐ No
Process Sludge Handling Program	☒ Yes	☐ No	See Design Bnef (Attachment 9)	☐ Yes	☐ No
Process /Effluent Monitoring Program	☐ Yes	☒ No		☐ Yes	☐ No
Site and Soil Assessment Report	☒ Yes	☐ No	See Design Brief (Attachment 9)	☐ Yes	☐ No
Environmental Impact Analysis (ground water)	☐ Yes	☒ No		☐ Yes	☐ No
Environmental Impact Analysis (surface water)	☐ Yes	☒ No		☐ Yes	☐ No
Environmental Impact Analysis (odour and noise)	☐ Yes	☒ No		☐ Yes	☐ No
Final Effluent Criteria Accepted by Regional Office of the Ministry	☒ Yes	☐ No	Attachment 8	☐ Yes	☐ No
Stormwater Management Report	☐ Yes	☒ No		☐ Yes	☐ No
Other Attached Information	☒ Yes	☐ No	Cost Form, Legal Survey, Class EA Approval, Pipe Data Form, SWP Consultation	☐ Yes	☐ No

12. Payment Information

Amount Enclosed: $ 7,000.00 *Please attach completed "Costs for EPA s.53 Applications – Supplement to Application for Approval" (PIBS 4107).*

Method of Payment

☐ Certified Cheque ☐ Money Order ☒ VISA ☐ MasterCard ☐ American Express

Credit Card Information *(if paying by VISA, MasterCard or American Express)**

Name on Card *(please print)*	Credit Card Number	Expiry Date (yy/mm)
Jane Finance	0123 4567 8910 1112	12/06

Cardholder Signature	Date *(y/m/d)*
Jane Finance	09/09/21

**NOTE: credit card accepted for payments UNDER $10,000.00 only.*

13. Statement of Client

I, the undersigned hereby declare that, to the best of my knowledge, the information contained herein and the information submitted in support of this application is complete and accurate in every way and that the Project Technical Information Contact identified in section 5 of this form is authorized to act on my behalf for the purpose of obtaining approval under Section 53 of the OWRA for the sewage works identified herein.

Name *(please print)*	Title
John Operations	Operations Manager, City of Anytown
Signature	Date *(y/m/d)*
J Operations	09/09/21

14. Statement of Municipality

I, the undersigned hereby declare on behalf of the Municipality, that the Municipality has no basic objection to the construction of the works in the Municipality.

Name and Title *(please print)*	Name of Municipality
John Operations, Operations Manager	City of Anytown
Signature	Date *(y/m/d)*
J Operations	09/09/21

ATTACHMENT 1

COST FORM

Ministry of the Environment | Ministère de l'Environnement

Ontario

Ce formulaire est disponible en français

COSTS FOR OWRA s.53 APPLICATIONS
SUPPLEMENT TO APPLICATION FOR APPROVAL

*This form is to be completed for all applications under the **Ontario Water Resources Act**, s.53 received by the Environmental Assessment & Approvals Branch. Please submit this form with your completed application form. For instructions/assistance completing this form, please refer to publication number 4180 titled: "Guide: Application Costs for Sewage Works, s.53 OWRA". This form and associated publications are available on the Ministry of the Environment web site at www.ene.gov.on.ca or by contacting the Environmental Assessment and Approvals Branch at 1-800-461-6290.*

Company Name:	Application/Certificate of Approval Number (if known)
City of Anytown	Previous C of A: 1234-567A8B

Application Cost: ***Indicate the applicable aspect(s) of the application and complete the corresponding section(s) of this form.***

Section 3

- ☐ Administrative amendment of an existing approval (Section 1)
- ☐ Fee exempted amendment or revocation of an existing approval (Section 2)
- ☒ Approval, amendment or revocation requiring technical review (Section 3)

Total Cost

$ **7000**

Print Form

SECTION 1: ***Administrative Amendment of an Existing Approval***

Description	Cost	(✓)
Administrative amendments (no technical review involved)	$ 100	☐
TOTAL COST:	$	

SECTION 2: ***Fee Exempted Amendment or Revocation of an Existing Approval***

Description	Cost	(✓)
Administrative revocation (no technical review involved)	$ 0	☐
Any revocation requested as a result of requirements imposed by conditions of an existing approval	$ 0	☐
Any amendment requested as a result of requirements imposed by conditions of an existing approval	$ 0	☐
TOTAL COST:	$	

SECTION 3: ***Complete tables 1, 2 & 3 and enter your information in the summary table below.***

	Description	Cost	(✓)
	Administrative processing	$ 200	✓
Table 1	Wastewater Treatment and Disposal (Table 1)	$ **5000**	☒
Table 2	Wastewater Disposal (Table 2)	$ **1800**	☒
Table 3	Review (Table 3)	$	☐
	Hearing (if required)	$ 18,000	☐
	TOTAL COST:	$ **7000**	

Table 1: Wastewater Treatment and Disposal

When completing this table, please note the following:

Category 1 Amendment:
The application relates to an amendment to an existing treatment plant approval to include additional facilities to increase the approved rated capacity of the plant, including the expansion, re-rating, or upgrading of an existing facility.

Category 2 Amendment:
The application relates to an amendment to an existing treatment plant approval to include additional facilities that do not increase the approved rated capacity of the plant, including new tertiary treatment facilities, plant process waste stream treatment and disposal facilities, new treatment facilities to replace deteriorated facilities and the establishment, alteration, expansion or replacement of an outfall.

Category 3 Amendment:
If the application relates to the alteration, extension or replacement of treatment plant equipment or processes that do not involve the addition of new facilities, including:

A. the alteration, extension or replacement of a pumping system, an aeration system, a chemical storage or application system, filter media or a standby power supply system,
B. the provision of additional points of process chemical application, and
C. the provision of odour control equipment facilities.

Category 4 Amendment:
Any other case of amendment requiring technical review.

Description	Maximum Design Capacity	Application Type	Amendment Category	Cost	(✓)	Ref.
A municipal or private facility for the treatment and disposal of sewage including a lagoon or stabilization pond or a sewage treatment plant	≤ 4,550 m³/day	Approval or Revocation*	N/A	$ 5,000	☐	1.1.1
		Amendment	Category 1	$ 5,000	☒	1.1.2
			Category 2	$ 3,600	☐	1.1.3
			Category 3	$ 1,800	☐	1.1.4
			Category 4	$ 600	☐	1.1.5
	> 4,550 m³/day	Approval or Revocation*	N/A	$ 10,000	☐	1.1.6
		Amendment	Category 1	$ 10,000	☐	1.1.7
			Category 2	$ 3,600	☐	1.1.8
			Category 3	$ 1,800	☐	1.1.9
			Category 4	$ 600	☐	1.1.10
A facility for attenuating stormwater runoff peak flow rate or volume or for managing stormwater runoff quality such as detention or retention ponds, underground chambers, oversized sewers, rooftop storage, parking lot storage, oil, grit and silt separators, flow control outlet structures, infiltration wells, perforated sewers, and trenches or outfalls	N/A	Approval or Revocation*	N/A	$ 2,000	☐	1.2.1
		Amendment	Category 1	$ 2,000	☐	1.2.2
			Category 2			
			Category 3			
			Category 4	$ 600	☐	1.2.3
A facility for the treatment and disposal of leachate	N/A	Approval or Revocation*	N/A	$ 6,000	☐	1.3.1
		Amendment	Category 1	$ 6,000	☐	1.3.2
			Category 2	$ 3,600	☐	1.3.3
			Category 3	$ 1,800	☐	1.3.4
			Category 4	$ 600	☐	1.3.5
A facility for the treatment and disposal of industrial process wastewater, including contact cooling water.	N/A	Approval or Revocation*	N/A	$ 6,000	☐	1.4.1
		Amendment	Category 1	$ 6,000	☐	1.4.2
			Category 2	$ 3,600	☐	1.4.3
			Category 3	$ 1,800	☐	1.4.4
			Category 4	$ 600	☐	1.4.5
				TOTAL COST:	**$ 5000**	

** revocation requiring technical review*

Back to Application Cost Section

Table 2: ***Wastewater Disposal***

Description	Design Capacity	Application Type	Increase in Design Capacity?	Cost	(✓)	Ref.
A subsurface disposal facility	≤ 15 m³/day	Approval or Revocation*	N/A	$ 600	☐	2.1.1
		Amendment	Yes	$ 600	☐	2.1.2
	> 15 m³/day, ≤ 50 m³/day	Approval or Revocation*	N/A	$ 1,500	☐	2.1.3
		Amendment	Yes	$ 1,500	☐	2.1.4
	> 50 m³/day	Approval or Revocation*	N/A	$ 3,000	☐	2.1.5
		Amendment	Yes	$ 3,000	☐	2.1.6
A facility for the disposal of spent water from a non-contact industrial cooling process.	N/A	Approval or Revocation*	N/A	$ 1,000	☐	2.2.1
		Amendment	Yes	$ 1,000	☐	2.2.2
Storm and sanitary sewers and appurtenances	N/A	Approval or Revocation*	N/A	$ 900	☐	2.3.1
		Amendment	Yes**	$ 900	☐	2.3.2
Storm and sanitary pump stations, force mains, and sanitary sewage detention chambers or oversized sewers.	N/A	Approval or Revocation*	N/A	$ 1,800	☒	2.4.1
		Amendment	Yes	$ 1,800	☐	2.4.2
			TOTAL COST:	**$ 1800**		

** revocation requiring technical review*

*** expansion of existing sewers*

Back to Application Cost Section

Table 3*: Review*

Description	Cost	(✓)
Review of Hydrogeological Assessment	$ 3,000	☐
Review of effluent quality criteria assessment for stormwater management, cooling water or soil remediation facilities	$ 1,400	☐
Review of effluent quality criteria assessment for municipal or private sewage, industrial process wastewater or leachate treatment plant	$ 6,000	☐
TOTAL COST:	$	

Back to Application Cost Section

ATTACHMENT 2

SUMMARY OF PRE-APPLICATION CONSULTATION

CONSULTING LTD.

123 Office Drive, Someplace, ON A1B 2C3
Telephone: 123-555-1234
Fax: 123-555-5678

MEMORANDUM

TO File

DATE May 26, 2008

CC Bill Representative, MOE Othertown District Office

FROM Jo Consultant, Consulting Ltd.

DOCUMENT No. 08-6543

ACME WWTP EXPANSION: PRE-APPLICATION CONSULTATION

Jo Consultant of Consulting Ltd. met with Bill Representative of the MOE on May 21, 2008 at the MOE's Othertown District Office to review the proposed expansion of the ACME Wastewater Treatment Plant (WWTP), located in Anytown, Ontario. Consulting Ltd. is currently preparing an addendum to the Environmental Study Report originally completed in September, 1997.

Jo Consultant outlined the nature of the expansion and identified the recommended wastewater treatment and disposal strategies. A summary of the information discussed is presented here:

- The expansion will more than double the capacity of the existing WWTP to support anticipated future population growth in the service area. Influent flow peaking factors were derived from analysis of recent historical flow data. Design influent quality was established based on historical influent quality and recommendations included in the Environmental Study Report.

- Construction of a new headworks facility (including screening and grit removal) is currently underway, overseen by another engineering firm. Modification of this facility was not included in the scope of the proposed expansion project.

- A secondary treatment system consisting of two rectangular aeration cells and two rectangular clarifiers designed in accordance with MOE Design Guidelines for Sewage Works (2008), is proposed and will operate in parallel with the existing secondary package plant.

- Proposal includes decommissioning of existing tertiary filters (in use since 1985) and construction of a new tertiary treatment facility, designed in accordance with MOE Design Guidelines, comprising continuous backwash sand filters arranged in a two-stage configuration for removal of phosphorus to very low levels.

- Relocation of the existing UV disinfection system may be necessary to accommodate the construction of the tertiary treatment system. The disinfection system will be expanded to provide 100 percent redundancy at the plant design peak flow, in accordance with MOE Design Guidelines.

- Effluent disposal practices (surface discharge to the Anytown River) will remain unchanged. An assimilative capacity study will be completed to determine appropriate effluent limits given the anticipated increase in wastewater flow through the plant. The existing effluent pipe will be replaced with a pipe approximately twice its diameter to accommodate this increase.

- Waste sludge produced in the secondary and tertiary treatment systems will be directed to the proposed sludge handling facility, which includes two gravity thickeners designed in accordance with MOE Design Guidelines and a large sludge holding tank. Thickened sludge will be periodically pumped from the sludge holding tank for transportation to another facility for stabilization and subsequent beneficial reuse.

- Recommended separation distances for odour mitigation between the WWTP and sensitive land uses (residential) are not satisfied. An odour control biofilter is proposed that would treat odourous air from the headworks building and sludge handling building.

In general, Bill Representative was in agreement with the proposed elements of the ACME WWTP expansion. In addition to the Certificate of Approval (Municipal and Private Sewage Works), Bill Representative noted the need for Consulting Ltd. to obtain the following:

- Written approval from the MOE's Technical Support Section of the proposed effluent criteria

- A permit from the Anytown River Valley Conservation Authority for work to be completed in or near the Anytown River during replacement of the WWTP effluent pipe and WWTP outfall

- A classification certificate for the expanded WWTP from the Ontario Water Wastewater Certification Office (OWWCO) to ensure compliance with O. Reg. 129/04, *Licensing of Sewage Works Operators*

- A Permit to Take Water for dewatering during construction of the proposed facilities

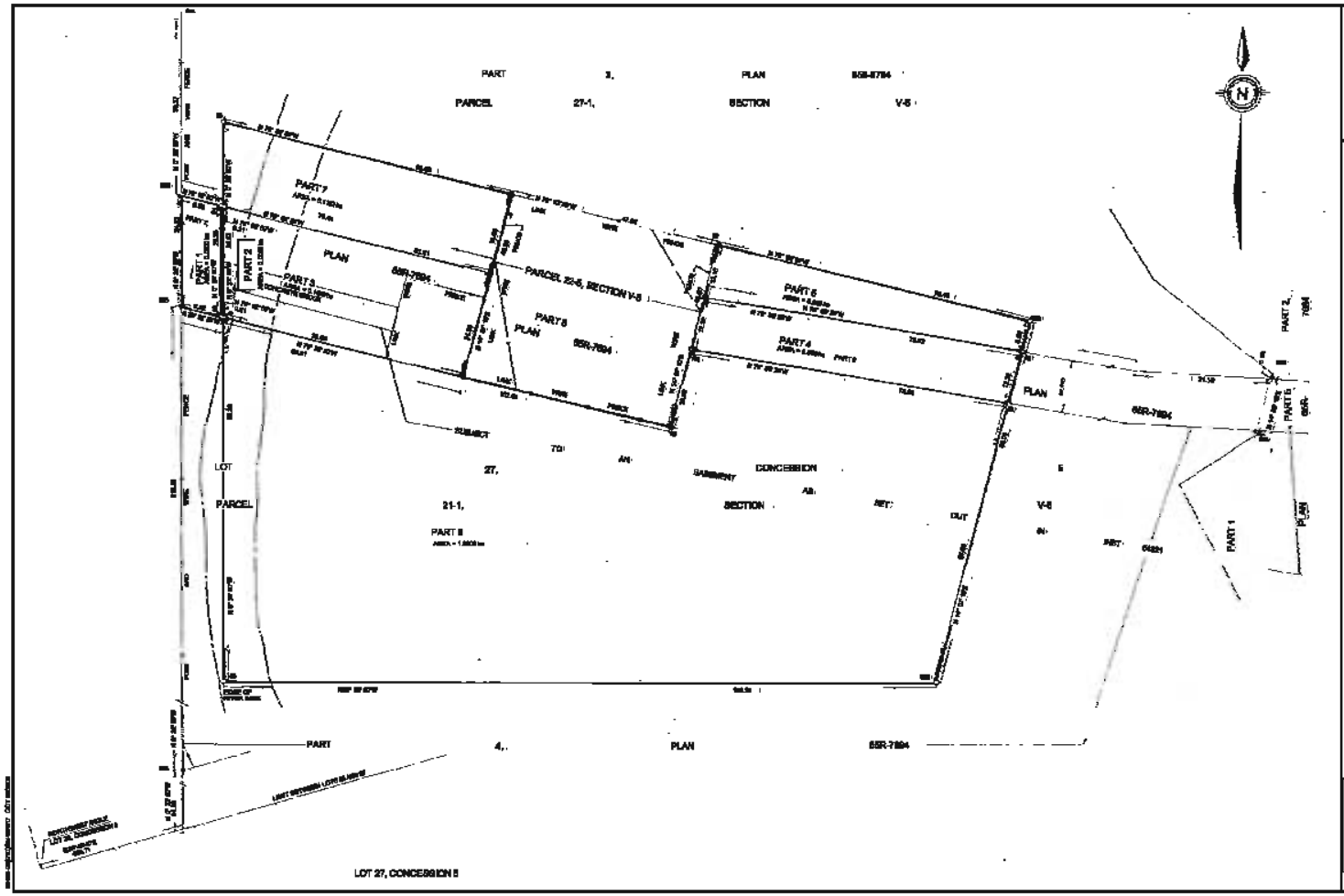
- A Certificate of Approval (Air) for existing and proposed stand-by generators and the proposed odour control unit

ATTACHMENT 3

SITE LEGAL SURVEY

NOTE: Please print legal survey on 11x17 paper for adequate legibility.

SURVEYOR'S COPY



I REQUIRE THIS PLAN TO BE DEPOSITED UNDER THE LAND TITLES ACT

DATE OCTOBER 9, 1112

I. Da Surveyor

ONTARIO LAND SURVEYOR

RECEIVED AND DEPOSITED

DATE October 3, 1113

Land Registrar

LAND REGISTRAR

PARTS 1 TO 7 (BOTH INCL.), PART OF PARCEL 27-1, SECTION V-5
PARTS 5, 6, 8 AND 9, SUBJECT TO AN EASEMENT AS SET OUT IN INST.

PLAN OF SURVEY OF
PART OF LOT 27, CONCESSION 5
CITY OF ANYTOWN

SCALE 1:800

20m 0 40m

SURVEYORS INC. 1982

METRIC

DISTANCES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048

LEGEND

SIP	DENOTES SURVEY MONUMENT PLANTED
IB	DENOTES SURVEY MONUMENT FOUND
IBs	DENOTES STANDARD IRON BAR
IR	DENOTES IRON BAR
C	DENOTES CUT IN CURB
MTC	DENOTES MINISTRY OF TRANSPORTATION
WIT	DENOTES WITNESS
M	DENOTES MEASURED
MMT	DENOTES MEASURED
WIT	DENOTES WITNESS
WIT	DENOTES WITNESS PLAN 65R-7694

CAUTION

THIS PLAN IS NOT A PLAN OF SUBDIVISION WITHIN THE MEANING OF THE PLANNING ACT.

SURVEYOR'S CERTIFICATE

I CERTIFY THAT:

1. THIS SURVEY AND PLAN ARE CORRECT IN ACCORDANCE WITH THE SURVEYS ACT AND THE LAND TITLES ACT AND THE REGULATIONS MADE THEREUNDER
2. THIS SURVEY WAS COMPLETED ON THE 4TH DAY OF OCTOBER, 1982

October 7, 1112
DATE

I. Da Surveyor
Ontario Land Surveyor

SURVEYORS INC.

DRAWN BY: EF | CHECKED BY: GH | SCALE 1:800 | REFERENCE NO. 10-84-257

ATTACHMENT 4

EXISTING CERTIFICATE OF APPROVAL
(C OF A No. 1234-567A8B)

ATTACHMENT 5

ENVIRONMENTAL STUDY REPORT

ENVIRONMENTAL STUDY REPORT

CLASS ENVIRONMENTAL ASSESSMENT
ACME Wastewater Treatment Plant Expansion

Anytown, Ontario



Submitted to:
The City of Anytown
321 Avenue Road
Anytown, Ontario
C3B 2A1

Prepared by:
Consulting Ltd.
123 Office Drive
Someplace, Ontario
A1B 2C3

SEPTEMBER 14, 1997

City of Anytown

ACME Wastewater Treatment Plant

CONSULTING LTD.

ATTACHMENT 6

ADDENDUM TO ENVIRONMENTAL STUDY REPORT

ENVIRONMENTAL STUDY REPORT

ADDENDUM

CLASS ENVIRONMENTAL ASSESSMENT
ACME Wastewater Treatment Plant Expansion

Anytown, Ontario



Submitted to:
The City of Anytown
321 Avenue Road
Anytown, Ontario
C3B 2A1

Prepared by:
Consulting Ltd.
123 Office Drive
Someplace, Ontario
A1B 2C3

JUNE 30, 2008

City of Anytown

ACME Wastewater Treatment Plant

CONSULTING LTD.

ATTACHMENT 7

LETTER OF CONFIRMATION – CLASS ENVIRONMENTAL ASSESSMENT

Ministry of the Environment

321 Green Street
4th Floor
Othertown, ON A2B 3C1

Ministère de l'Environnement

321 Rue Green
4e étage
Othertown, ON A2B 3C1

Ontario

Tel: (123) 555-0000
Fax: (123) 555-1111

August 20, 2008

Jo Consultant
Consulting Ltd.
123 Office Drive
Someplace, Ontario
A1B 2C3

Dear Ms. Consultant:

RE: Environmental Study Report Addendum
ACME Wastewater Treatment Plant Expansion Project
City of Anytown

Consulting Ltd. completed an Environmental Study Report (ESR) for the expansion of the ACME Wastewater Treatment Plant (WWTP) in September 1997. The ESR was placed on the public record for a 30-day review period in accordance with the requirements of the Municipal Engineers Association's *Municipal Class Environmental Assessment* (Class EA). The review period yielded no Part II (bump-up) requests and the project was approved to proceed in accordance with the approach presented in the ESR and subject to any required permits and approvals.

As of September 2007, construction had not yet commenced and the 10-year Class EA approval period expired. Consulting Ltd. prepared an addendum to the 1997 ESR to address any changes in environmental conditions, potential environmental impacts, and the preferred treatment approach since the initial Class EA. The MOE acknowledged receipt of the Draft ESR Addendum in a letter dated May 22, 2008. Technical Support Section comments on the Draft were sent to J. Consultant of Consulting, Ltd. on June 18, 2008. Comments were addressed to the MOE's satisfaction in the Final ESR Addendum, dated June 30, 2008.

On July 7, 2008, the City of Anytown (City) issued a Notice of Filing of Addendum (attached), and the Final ESR Addendum was placed on the public record for a 30-day review period in accordance with the requirements of the Class EA. No comments were received during the review period.

The Minister is satisfied that the Class EA and preparation of the ESR Addendum followed the approved environmental planning process for an integrated approach under the Municipal Class EA, and has no outstanding concerns that cannot be addressed through conditions of approval. The City may proceed with the design and construction of the ACME WWTP expansion, in

accordance with the approach presented in the ESR Addendum and subject to any required permits and approvals.

Please note that failure to comply with the *Environmental Assessment Act* (EAA), the provisions of the Class EA and the conditions of the Minister's decision, and failure to implement the project in the manner described in the Final ESR are contraventions of the EAA and may result in persecution under Section 38 of the Act.

Thank you for the opportunity to comment on this project. Should you or any members of your project team have any questions regarding the above, please feel free to contact me at 123-555-4321.

Yours truly,



Don Planner
Environmental Resource Planner and EA Coordinator
Air, Pesticides and Environmental Planning

Attachment: Notice of Filing of Addendum

NOTICE OF FILING OF ADDENDUM

CITY OF ANYTOWN
CLASS ENVIRONMENTAL ASSESSMENT
ACME WASTEWATER TREATMENT PLANT EXPANSION

A Class Environmental Assessment (Class EA) was completed in 1997 for the expansion of the ACME Wastewater Treatment Plant (WWTP). An Environmental Study Report (ESR), dated September 14, 1997 was placed on the public record for a 30-day review period in accordance with the requirements of the Municipal Engineers Association's *Municipal Class Environmental Assessment* (Class EA). Subsequent to the review period, the project was approved to proceed in accordance with the approach presented in the ESR and subject to any required permits and approvals.

In September 2007, the 10-year Class EA approval period expired. An addendum to the ESR was prepared to address any changes in environmental conditions, potential environmental impacts, and the preferred treatment approach since the initial Class EA.

By this Notice, the Addendum is being placed on the public record for review in accordance with the requirements of the Class EA. Subject to comments received as a result of this Notice, the City of Anytown intends to proceed with the construction of this project in the spring of 2010.

The Addendum is available for review from Monday July 7, 2008 to Wednesday August 6, 2008 at the following locations:

Anytown City Hall
321 Avenue Road
Anytown, ON

Mon-Fri: 8:30 am – 4:30 pm
Telephone: 125-555-4321

Anytown Community Resource Centre
8910 Court Street
Anytown, ON

Mon-Sat: 9:00 am – 9:00 pm
Telephone: 123-555-8888

Further information may be obtained from the City's consultants on this project:

Consulting Ltd.
123 Office Dr.
Someplace, ON
A1B 2C3

Telephone: 123-555-1234

Attn: Jo Consultant

ATTACHMENT 8

LETTER OF ACCEPTANCE – EFFLUENT CRITERIA

Ministry of the Environment

321 Green Street
4th Floor
Othertown, ON A2B 3C1

Ministère de l'Environnement

321 Rue Green
4e étage
Othertown, ON A2B 3C1

Ontario

Tel: (123) 555-0000
Fax: (123) 555-1111

April 12, 2008

Jo Consultant
Consulting Ltd.
123 Office Drive
Someplace, Ontario
A1B 2C3

Dear Ms. Consultant:

RE: Assimilative Capacity Study
ACME WWTP Expansion Project
City of Anytown

A meeting was held on March 31, 2008 to review the assimilative capacity study dated March 17, 2008 prepared by Consulting Ltd. for the ACME WWTP expansion.

The Technical Support Section is in agreement with the recommendations made in the report with respect to design objectives and compliance limits for treated plant effluent to be discharged to the Anytown River, a Policy 2 receiver. Effluent criteria are summarized below:

Proposed Effluent Criteria for Expanded ACME WWTP

Parameter		Effluent Concentration Objective	Effluent Concentration Limit (monthly average)	Waste Loading Limit (monthly average)
BOD_5		5 mg/L	10 mg/L	28.74 kg/d
TSS		5 mg/L	10 mg/L	28.74 kg/d
TP		0.125 mg/L	0.20 mg/L	0.57 kg/d
TAN	May-Oct	0.35 mg/L	0.35 mg/L	1.01 kg/d
	Nov-Apr		1.0 mg/L	2.87 kg/d

Effluent monitoring requirements will be unchanged from current requirements. Special monitoring of effluent and receiving water, including toxicity testing, will not be required at this location at this time.

Please let us know if there are any other questions. Thank you for the opportunity to comment.

Yours truly,



Don Planner
Environmental Resource Planner and EA Coordinator
Air, Pesticides and Environmental Planning

ATTACHMENT 9

DESIGN BRIEF

DESIGN BRIEF

ACME Wastewater Treatment Plant Expansion

Anytown, Ontario



Submitted to:
The City of Anytown
321 Avenue Road
Anytown, Ontario
C3B 2A1

Prepared by:
Consulting Ltd.
123 Office Drive
Someplace, Ontario
A1B 2C3

SEPTEMBER 2, 2009

City of Anytown
ACME Wastewater Treatment Plant

CONSULTING LTD.

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1.0 INTRODUCTION

In 1997, Consulting Ltd. completed a Class Environmental Assessment to evaluate alternatives for meeting future wastewater servicing needs in the City of Anytown (City). The Environmental Study Report (ESR) documented the evaluation process and recommended the expansion of the ACME Wastewater Treatment Plant (WWTP) and the Boulevard Road Pumping Station (PS) to accommodate future population growth within the Anytown service area. The 10-year Class EA approval lapsed in September 2007. Consulting Ltd. prepared an addendum to the ESR to evaluate changes in environmental conditions, potential environmental impacts, and the preferred treatment approach since the completion of the original ESR. The Addendum verified that the project approach and mitigation measures identified in the original ESR remain valid given the current planning context.

Consulting Ltd. was retained by the City to provide detailed design services, contract administration, and site inspection services for the ACME WWTP/Boulevard Road PS Expansion Project. Consulting Ltd. developed a design to expand the plant to a rated capacity of 2,874 cubic metres per day (m^3/d) from its current 1,205 m^3/d capacity. The capacity of the Boulevard Road PS will also be upgraded to correspond to the expanded WWTP design peak hour flow.

This design brief presents details of the final design for the ACME WWTP/Boulevard Road PS expansion, including:

- description of the existing and proposed facilities;
- basic data on the volume and composition of the wastewater generated in the service area;
- summary of the proposed effluent quality criteria;
- detailed description of all proposed treatment units and equipment, and identification of process design parameters;
- detailed process design and sizing calculations for all major treatment processes;
- hydraulic calculations for all process streams within the wastewater treatment works;
- description of the measures to be taken during construction to ensure uninterrupted treatment of all incoming wastewater for the duration of the construction period; and
- overview of contingency planning measures for the proposed facilities in the event of spills and/or equipment failure.

2.0 DESCRIPTION OF EXISTING SEWAGE WORKS

2.1 Anytown Wastewater Collection System

Sanitary wastewater generated within the City of Anytown is collected in sanitary sewers and conveyed by a combination of gravity sewers, pumping stations and force mains for treatment at the ACME WWTP. The collection system, including three pumping stations is owned and operated by the City of Anytown.

2.2 Boulevard Road PS

The Boulevard Road PS is located approximately 800 metres (m) from the ACME WWTP. The station forcemain is 400 millimetres (mm) in diameter and discharges directly to the WWTP influent chamber. The PS is of a wet well/dry well configuration and is currently equipped with 2 dry-pit submersible sewage pumps rated at 112 litres per second (L/s) (9,677 m^3/d) at 16.8 m total dynamic head (TDH). The forcemain header has connections for two additional process pumps. The wet well is split into two chambers that are hydraulically connected by a 300 mm sluice gate. The station wet wells are connected to two incoming gravity sewers at diameters of 533 mm and 380 mm.

2.3 ACME WWTP

2.3.1 Existing WWTP

The current ACME WWTP configuration was established in the late-1980s. According to the current C of A (1234-567A8B, issued on December 15, 1993), the ACME WWTP has a rated capacity of 1,205 m^3/d and a peak flow rate of 4,218 m^3/d. The existing works include:

- manually-cleaned bar screens;
- a grit removal system consisting of a grit tank with mechanical mixer, air lift pump, air and water scour devices, blowers and grit clarifier;
- an aeration tank in an annular ring, equipped with a coarse bubble diffused air system;
- a central, circular clarifier with influent well, scum baffle and sludge scraping system;
- a two-stage aerobic digester for sludge stabilization;

- a tertiary treatment system made up of 3 upflow deep bed sand filters using continuous filtration, continuous backwash and continuous air scour; and
- a UV disinfection system consisting of two banks, each equipped with 16 lamps.

Treated wastewater is discharged to the Anytown River. Stabilized sludge is hauled off-site for disposal.

Three building structures are currently located on the WWTP site. The Main Building houses the plant headworks, tertiary filters, chemical feed and storage, sludge pumps, electrical switchgear and maintenance area. The plant office and laboratory are contained in another building, and the UV channel is outside.

2.3.2 Current Upgrades Project

Work is currently underway to upgrade several features of the ACME WWTP in preparation for the expansion. These upgrades were approved under a separate Class EA and have been designed by another consulting firm (CWR Inc.). Elements of the current upgrades project include:

- expansion of the existing headworks and construction of a new headworks building;
- installation of one new aeration blower, and variable frequency drives (VFDs) on the existing blowers;
- installation of a flow meter and VFD on the existing return/waste activated sludge pumps;
- construction of new influent and effluent flow meters;
- installation of new alum feed pumps and modifications to the chemical containment area;
- installation of a new backup power generator;
- replacement of the sand filter media and air lift piping;
- replacement of both UV disinfection banks;
- construction of a flow splitter chamber to allow connection to the expanded facilities; and
- installation of Supervisory Control and Data Acquisition (SCADA) monitoring and control.

Completion of these upgrades is scheduled for November 2009. Coordination between Consulting Ltd. and CWR Inc. was important during detailed design of the WWTP expansion.

3.0 OVERVIEW OF PROPOSED EXPANSION

3.1 Boulevard Road PS

The WWTP expansion project will see the installation of a single new sewage pump to increase the firm capacity of the Boulevard Road PS. The station's existing control panel will also be upgraded, and a discharge flow and pressure monitoring system will be installed.

3.2 ACME WWTP

3.2.1 Elements of the Expansion

The ESR and ESR Addendum prepared to summarize the evaluation of alternatives for meeting future wastewater servicing needs in the City of Anytown recommended implementation of the following works for expansion of the ACME WWTP:

- new secondary treatment facilities, including extended aeration basins, secondary clarifiers, recycle/waste pumps and blowers;
- new two stage tertiary treatment facilities;
- decommissioning of existing tertiary treatment facilities
- additional disinfection facilities;
- new sludge handling facilities; and
- associated structures and facilities to support the expansion.

The existing secondary treatment system will not be modified and will remain in use, providing approximately 42 percent of the design capacity of the expanded WWTP. The new secondary treatment system will provide the remaining capacity and will consist of two rectangular aeration basins and two rectangular clarifiers.

Tertiary treatment at the expanded plant will be provided by a two-stage system of upflow, continuous backwash sand filters. The existing sand filters will be decommissioned; a new tertiary treatment building is to be constructed adjacent to the Main Building.

New UV disinfection channels will be constructed and will have a hydraulic capacity greater than the design peak hour flow to allow for future expansion. The purchase of new UV disinfection

equipment will be necessary, but wherever possible, equipment will be salvaged from the existing UV disinfection system.

New sludge handling facilities will also be constructed. A building will be erected adjacent to the new headworks building. The building will house two gravity sludge thickeners and a large aerated holding tank. Sludge will be transferred from the holding tank to another facility for stabilization prior to disposal. An odour control system will also be installed to mitigate the release of odours from the headworks facility and the new sludge handling facility.

3.2.2 Description of Proposed Site Layout

ACME WWTP influent flows enter the site at the northeast corner of the property via an existing forcemain originating at the Boulevard Road PS. Flow will continue by gravity to the new headworks building. After screening and grit removal, flow will exit the headworks through an existing plant influent flow meter and the existing flow distribution chamber.

The existing distribution chamber will proportion flow between the existing package plant (42 percent) and the new secondary treatment facilities (58 percent). The chamber will be modified to ensure consistent flow-splitting over a range of plant flow conditions. Flow to the new secondary treatment system will be measured by a magnetic flow meter.

The new secondary treatment facilities will consist of two aeration basins, two rectangular clarifiers, situated in the southeast quadrant of the site. Footprint is available at this location for future expansion of the secondary treatment system. Slide gates will be used on the aeration basin inlet to permit isolation of either treatment train for maintenance. Effluent from the aeration basins will flow over a weir into a common channel to permit discharge to one or both secondary clarifiers. The return activated sludge (RAS) and waste activated sludge (WAS) pumps will be located in a dry well between the aeration basins and clarifiers. Two new blowers will also be located in the new structure.

Flow from the existing and new secondary treatment system will be combined in the new UV/tertiary treatment building, adjacent to the existing Main Building. . The existing UV channel will be demolished to allow for construction of this new building, which will house the two-pass, upflow, continuous backwash sand filtration system and the new UV disinfection system.

Secondary effluent will be dosed with alum in a mixing chamber before entering the first-stage filter beds, where flocculation will occur. Filter influent will enter near the bottom of the filter beds and will flow upward. Filtrate from the first-stage filters will flow over an effluent weir near the top of the modules and into the second-stage filters. From the second stage filters, effluent

will be conveyed to the new UV disinfection system in the northwest corner of the building. Filter reject (backwash) will be thickened in a lamella gravity settler before processing in the new sludge handling system.

The new UV disinfection system will contain four new UV banks installed in two channels to permit 100 percent redundant operation at peak design flow. Each channel also contains a width reduction baffle, which may be removed in the future to permit the installation of additional UV modules and increase the capacity of the disinfection system to 20,000 m^3/d. Effluent from the UV disinfection system will be collected in the plant process water sump, which will supply water for flushing and wash down activities throughout the expanded plant.

From the plant process water sump, disinfected effluent that is not required for flushing of wash down will flow by gravity through the effluent flow meter (relocated from its current location to the northwest corner of the tertiary treatment building). Effluent will be discharged to the Anytown River via a new 600-mm diameter outfall pipe that will run parallel to the existing outfall (to be decommissioned).

A new sludge handling building will be constructed adjacent to the new headworks building in the northeast corner of the site. The building will house two new gravity sludge thickeners and an aerated sludge holding tank. WAS from the existing and new secondary treatment systems, as well as sludge from the Lamella gravity settler, will be pumped to the new sludge thickeners. Thickened sludge will be stored below the thickeners in the sludge holding tank. Sludge will be periodically pumped from the tank and transported to another facility for stabilization and disposal.

A new road will be constructed to permit truck access to the sludge handling facility, as well as to the other new facilities.

Refer to the Engineering Design Drawings package for detailed site layout drawings including the existing works, proposed works, and proposed decommissioning.

4.0 DESIGN CRITERIA

4.1 Design Flows

4.1.1 Historical Flow Data and Current Design Flows

Historical flow data collected during the preparation of the ESR for the period 1993-1996 is summarised in Table 1. During preparation of the ESR addendum, this data was compared to flows for the period 2005-2007, which are summarised in Table 2.

TABLE 1: ACME WWTP – WASTEWATER FLOW, 1993 – 1996

Condition	Flow (m^3/d)				
	1993	**1994**	**1995**	**1996**	**1993-1996**
Annual Average Day Flow (% Average Capacity)	651 (54)	814 (68)	974 (81)	944 (78)	846[1] (70)
Maximum Month Average Day Flow	n/a	n/a	n/a	n/a	n/a
Maximum Day Flow	1,377	1,613	1,934	1,726	1,934[2]
Minimum Day Flow	n/a	n/a	n/a	n/a	n/a

1 Mean annual average day flow over the period (1993-1996).

2 Maximum day flow from 1993 to 1996.

TABLE 2: ACME WWTP – WASTEWATER FLOW, 2005 – 2007

Condition	Flow (m^3/d)			
	2005	2006	2007	2005-2007
Annual Average Day Flow (% Average Capacity)	998 (83)	1,067 (89)	1,006 (83)	1,024[1] (85)
Maximum Month Average Day Flow	1,291	1,248	1,204	1,291[2]
Maximum Day Flow	1,864	2,097	1,895	2,097[3]
Minimum Day Flow	691	753	797	691[4]

1 Mean annual average day flow over the period (2005-2007).

2 Maximum month average day flow from 2005 to 2007.

3 Maximum day flow from 2005 to 2007.

4 Minimum day flow from 2005 to 2007.

Average daily flows have increased about 21 percent since the mid-1990's, a reflection of population growth in the area. The more recent dataset was assumed to represent the current operating conditions and was used to calculate flow peaking factors for the design of the WWTP expansion. The average ratios of various flow conditions to the annual average day flow are listed in Table 3.

TABLE 3: ACME WWTP – WASTEWATER FLOW RATIOS

Flow Condition	Average Ratio
Maximum Monthly Average Daily Flow	1.22
Maximum Daily Flow	2.04
Minimum Daily Flow	0.67
Peak Hourly Flow	4.0

4.1.2 Proposed Design Flows

The flows used in the design of the expanded ACME WWTP are presented in Table 4. The combined capacity of the existing WWTP and the proposed expansion is equal to the design plant rated capacity. The capacity of the existing secondary treatment system will remain equal to the

existing plant rated capacity while the design of the new secondary treatment plant was based on wastewater flows to the expansion. Design of the new tertiary treatment system and the expanded UV disinfection systems was based on the combined flow from the existing WWTP and the new secondary treatment system.

TABLE 4: ACME WWTP EXPANSION – PROPOSED DESIGN FLOWS

Design Condition	Flow (m^3/d)	Flow Distribution	
		Existing Plant (m^3/d)	Proposed Plant Expansion (m^3/d)
Annual Average Daily Flow (AADF)	2,874	1,205	1,669
Maximum Month Average Daily Flow (MMADF)	3,506	1,470	2,036
Maximum Daily Flow (MDF)	5,863	2,458	3,405
Minimum Daily Flow (MinDF)	1,926	807	1,118
Peak Hourly Flow (PHF)	11,496	4,820	6,676

Current flows were also considered during the design, as the expanded facility must operate under both current and future conditions.

4.2 Influent Characterization

4.2.1 Historical Influent Water Quality

Influent wastewater quality data from 2006 – 2007 (Table 5) was used in the development of design criteria for the expanded plant. Data from this period is assumed to be most representative of current operation. Data gathered during preparation of the initial ESR showed similar influent characteristics from 1993 – 1996.

TABLE 5: ACME WWTP – INFLUENT WASTEWATER QUALITY

Parameter	2006 – 2007 Influent Characteristics			1993 – 1996 Influent Characteristics (Average)
	Average	Minimum	Maximum	
$CBOD_5$ (mg/L)	114	41	250	n/a
BOD_5 (mg/L)	140	59	267	139
TSS (mg/L)	175	50	403	182
TP (mg/L)	4.6	2.4	7.5	4.9
TKN(mg/L)	32	17	49	31
TAN (mg/L)	20	10	26	n/a
pH	7.6	7.2	7.8	n/a
Temperature (ºC)	15.8	10.4	19.7	n/a

4.2.2 Proposed Design Influent Characterization

Table 6 presents design average and peak influent contaminant concentrations for the ACME WWTP expansion. Design concentrations are based on recommendations presented in the ESR and the ESR Addendum, and represent typical conditions experienced at municipal wastewater treatment facilities. These values are conservative in that they are greater than the historical average concentrations measured at the ACME WWTP.

TABLE 6: ACME WWTP EXPANSION – PROPOSED DESIGN INFLUENT QUALITY

Parameter	Design Concentration (mg/L)	
	Average	Peak
$CBOD_5$	150	270
BOD_5	180	324
TSS	200	396
TKN	30	54
TAN	20	36
TP	9	16

4.3 Effluent Requirements

4.3.1 Historical Effluent Water Quality

Historical effluent water quality for 1993-1996 and 2006-2007 are presented in Table 7.

TABLE 7: ACME WWTP – EFFLUENT QUALITY

Parameter	Effluent Characteristics	
	1993 – 1996	2006 – 2007
$CBOD_5$ (mg/L)	1.30	1.31
BOD_5 (mg/L)	n/a	1.71
TSS (mg/L)	3.10	5.02
TP (mg/L)	0.12	0.13
TKN(mg/L)	n/a	0.77
TAN (mg/L)	0.23	0.12
pH	n/a	7.4
Temperature (ºC)	n/a	12.1

4.3.2 Assimilative Capacity Assessment

As part of ESR Addendum activities for this project, an Assimilative Capacity Study was undertaken to establish appropriate effluent limits for the design of the expanded ACME WWTP. A focus of the evaluation was the discharge of total phosphorus, for which the Anytown River has been designated a Policy 2 receiver. A technical memorandum (Consulting Ltd., March 2008) summarising these efforts is attached (Appendix A). The memo:

- addresses the outstanding issues identified by the MOE with respect to the ESR (September 2007) prepared by Consulting Ltd.;
- reviews regulatory requirements for wastewater treatment plant discharges in the province of Ontario;

- presents the results of mixing zone modelling required to determine the size of the mixing zone, as requested by the MOE; and
- recommends effluent criteria based on the study findings.

In a letter dated April 12, 2008, the MOE's technical support section approved the assimilative capacity study and indicated agreement with the proposed effluent limits.

4.3.3 Proposed Design Effluent Criteria

Approved effluent limits and proposed design effluent objectives for the expanded ACME WWTP are presented in Table 8. The effluent objectives and compliance limits are based on recommendations from the ESR and the findings of the Assimilative Capacity Study, assuming an average effluent discharge rate of 2,874 m^3/d. Limits on monthly average contaminant loadings may be calculated based on effluent compliance limits and the approved average daily flow.

TABLE 8: ACME WWTP EXPANSION – PROPOSED EFFLUENT CRITERIA

Parameter		Effluent Criteria			
		Current		Proposed	
		Objective	Compliance Limit	Objective	Compliance Limit
$CBOD_5$ (mg/L)		5	15	5	10
TSS (mg/L)		5	15	5	10
TAN (mg/L)	May - Oct	0.35	0.35	0.35	0.35
	Nov - Apr		1		1.0
TP (mg/L)		0.3	0.3	0.07	0.1
Total Residual Chorine (mg/L)		Absent	<0.002	Absent	<0.002
E. Coli (counts/100ml)		<200	<200	<200	<200
pH		n/a	6.0 to 9.5	n/a	6.0 to 9.5

5.0 PUMP STATION DESIGN

5.1 Design Basis

The expected average dry weather flow to the Boulevard Road PS is equivalent to the design average day flow to the expanded ACME WWTP (2,874 m^3/d). The design peak flow is 11,496 m^3/d (133 L/s), based on analysis of historic variations in wastewater flow. This comprises an estimated peak domestic wastewater flow of 8,456 m^3/d and an infiltration allowance of 3,040 m^3/d. The peak domestic flow was calculated based on the expected future population of the service area, a per capita wastewater generation rate of 360 L/cap/d, and a peaking factor related to the population of the service area. An infiltration flow of 3,040 m^3/d represents a wet weather infiltration rate of approximately 0.2 L/s/ha. This is consistent with the findings of recent studies of the Anytown wastewater collection system. Table 9 summarizes characteristics of the tributary and design flow criteria.

TABLE 9: BOULEVARD ROAD PS UPGRADE – DESIGN BASIS

Design Parameter		Unit	Value
Tributary	A) Residential	ha	142.7
	B) Commercial	ha	35.0
	C) Industrial	ha	0
Design Population (or Equivalent)	A) Residential	No.	6,256
	B) Commercial	No.	5,111
	C) Industrial	No.	0
Average Per Capita Wastewater Flow		L/cap.d	360
Average Dry Weather Wastewater Flow		L/s	33.3
Design Peak Wastewater Flow		L/s	133.1
Peak Domestic Flow		L/s	97.9
Infiltration Flow		L/s	35.2

5.2 MOE Design Criteria

The Boulevard Road PS capacity upgrade will involve the installation of a third sewage pump in the station dry well. The pump will connect to the existing forcemain header.

Section 7 of the Design Guidelines for Sewage Works addresses the design of sewage pumping stations. Table 10 summarizes recommendations applicable to the capacity upgrade. Note that the Boulevard Road PS possesses a dry well/wet well configuration that currently meets all applicable requirements. Neither the dry well nor the wet well will be modified during the upgrade. Forcemain design will also be unchanged.

TABLE 10: BOULEVARD ROAD PS UPGRADE – APPLICABLE MOE DESIGN CRITERIA

Parameter	Recommended Value
Minimum Pump Suction Opening (mm)	100
Minimum Pump Discharge Opening (mm)	100
Minimum Large Solids Capacity (mm)	80
Maximum Forcemain Velocity (m/s)	3.0
Minimum Forcemain Velocity (m/s)	0.6

5.3 Hydraulic Design Calculations

Section 7.2.3 of the Design Guidelines for Sewage Works recommends that the design of pumping stations be based on system head calculations and curves for three conditions using the appropriate Hazen-Williams factor "C" as follows:

- Low sewage level in the wet well, C = 120;
- Median sewage level over the normal operating range in the wet well, C = 130; and
- Overflow sewage level in the wet well, C = 140.

Detailed hydraulic calculations were performed for each of these conditions during the design of the expanded pumping station to determine appropriate pump sizing and verify forcemain design. These calculations may be found in Appendix B.

5.4 Design Summary

Table 11 summarizes the results of system head calculations as described above.

TABLE 11: BOULEVARD ROAD PS UPGRADE – DESIGN CALCULATION SUMMARY

Parameter	C = 120	C = 130	C = 140
Pump Design Flow (L/s)	130	130	130
Forcemain Head Loss (m)	2.4	2.0	1.7
Suction Line Head Loss (m)	0.3	0.3	0.3
Discharge Line Head Loss (m)	0.3	0.3	0.3
Total Head Loss (m)	3.0	2.6	2.3
Low Wet Well Water Level (m)	171.92	-	-
Median Wet Well Water Level (m)	-	172.03	-
High Wet Well Water Level (m)	-	-	173.18
Forcemain End Elevation (m)	185.92	185.92	185.92
Maximum Static Head (m)	14.0	13.8	12.7
Minimum Static Head (m)	12.7	12.7	12.7
Maximum Total Dynamic Head (m)	17.0	16.4	15.0
Minimum Total Dynamic Head (m)	15.7	15.3	15.0

As per the Design Guidelines for Sewage Works, the median system-head curve (C = 130) was used to select the pump and motor, since this condition best reflects normal operating conditions. Table 12 lists characteristics of the selected pump and proposed piping installation.

TABLE 12: BOULEVARD ROAD PS UPGRADE – DESIGN SUMMARY

Parameter	Value
Pump Capacity (L/s)	130
Pump Suction Opening (mm)	300
Pump Discharge Opening (mm)	200
Impeller Diameter (mm)	354
Large Solids Capacity (mm)	100
Power (hp)	45
Pump Speed (rpm)	1175
Forcemain Velocity (m/s)	0.9 – 1.4

5.5 Emergency Backup Power

The Design Guidelines for Sewage Works recommends that emergency pumping capability be accomplished by the provision of portable or in-place internal combustion equipment, or by the provision of portable pumping equipment.

The Boulevard Road PS is currently equipped with a transfer switch and exterior receptacle to provide emergency backup power from a portable generator in the event of a power failure. The pump station has sufficient wastewater storage capacity and an alarm system to allow time for detection of pump station failure and transportation and connection of the generating equipment.

The generating equipment has sufficient capacity to start up and maintain the new design capacity of the station. The system is also adequate to provide power for essential lighting and ventilation.

6.0 SECONDARY TREATMENT SYSTEM DESIGN

6.1 Design Basis

The existing secondary treatment system will not be modified. The wastewater stream will be split in the modified distribution box; the new secondary treatment system will treat approximately 58 percent of the plant flow under all flow conditions. Table 13 presents the design flows for the new secondary treatment system.

TABLE 13: PROPOSED SECONDARY TREATMENT – DESIGN FLOWS

Condition	Flow (m^3/d)
Annual Average Daily Flow (AADF)	1,669
Maximum Month Average Daily Flow (MMADF)	2,036
Maximum Daily Flow (MDF)	3,405
Minimum Daily Flow (MinDF)	1,118
Peak Hourly Flow (PHF)	6,676

A change in influent character is not anticipated. The design contaminant concentrations for the new secondary treatment system (Table 14) are based on existing design contaminant concentrations and historical analysis of wastewater at the ACME WWTP.

TABLE 14: SECONDARY TREATMENT – DESIGN INFLUENT QUALITY

Parameter	Average	Peak
$CBOD_5$ (mg/L)	150	270
BOD_5 (mg/L)	180	324
TSS(mg/L)	200	396
TKN (mg/L)	30	54
TAN (mg/L)	20	36
TP (mg/L)	9	16
Temperature (ºC)	10	20

6.2 MOE Design Criteria

6.2.1 Biological Treatment

During the Class EA process, extended aeration was identified as the preferred alternative for expansion of the secondary treatment capacity of the ACME WWTP for its proven performance, economic value, and relatively simple operation.

Section 12 of the Design Guidelines for Sewage Works discusses design, construction, and operational considerations related to biological wastewater treatment processes. Table 15 lists general recommendations for the design of aeration basins. Table 16 summarizes process design recommendations for extended aeration systems.

TABLE 15: AERATION BASINS – APPLICABLE MOE DESIGN CRITERIA

Basin Parameter	Recommended Value
SWD (m)	3.5 - 4.6
Length:Width	1:1 - 3:1

TABLE 16: EXTENDED AERATION – APPLICABLE MOE DESIGN CRITERIA

Process Parameter	Recommended Value
Organic Loading Rate (kg $BOD_5/(m^3d)$) [1]	0.17 - 0.24
F/M (d^{-1})	0.05 - 0.15
Minimum HRT at AADF (h)	15
RAS Rate (% AADF)	50 - 200
Minimum SRT (d)	15
MLSS Concentration (mg/L)	3000 - 5000
Mixing Requirements ($L/(m^2s)$) [2]	0.61

1 kg $BOD_5/(m^3d)$ refers to the mass loading of BOD_5 per cubic metre of capacity of the aeration basins.

2 $L/(m^2s)$ refers to the volumetric rate of airflow required per square metre of surface area of the aeration basins when fine-bubble diffusers are used.

6.2.2 Sedimentation

The extended aeration treatment process includes sedimentation, or clarification, during which suspended solids (including biomass) are allowed to settle, producing clarified effluent and activated sludge.

Section 13 of the Design Guidelines for Sewage Works discusses design, construction, and operational considerations related to secondary sedimentation. Table 17 lists general recommendations for the design of secondary sedimentation basins (secondary clarifiers). Table 18 summarizes process design recommendations for secondary sedimentation.

TABLE 17: SECONDARY CLARIFIERS – APPLICABLE MOE DESIGN CRITERIA

Basin Parameter	Recommended Value
Minimum Flow Length (m)	3.7
SWD (m)	3.6 - 4.6
Length:Width	4:1
Width:Depth	1:1 - 2.25:1

TABLE 18: SECONDARY SEDIMENTATION – APPLICABLE MOE DESIGN CRITERIA

Process Parameter	Recommended Value
Surface Overflow Rate at Peak Hourly Flow ($m^3/(m^2d)$) [1]	37
Peak Solids Loading ($kg/(m^2d)$) [2]	170
Effluent Weir Loading Rate at Peak Hourly Flow ($m^3/(md)$) [3]	250

1 $m^3/(m^2d)$) refers to the volumetric flowrate of clarified effluent per square metre of surface area of the secondary clarifiers.

2 $kg/(m^2d)$) refers to the mass loading of solids to each square metre of surface area of the secondary clarifiers.

3 $m^3/(md)$ refers to the volumetric flowrate of clarified effluent per metre of effluent weir.

Settled sludge will be collected by a chain and flight system and directed to multiple sludge hoppers, from which sludge pumps draw. The Design Guidelines for Sewage Works includes recommendations related to the design of sludge hoppers. Table 19 summarizes these recommendations.

TABLE 19: SECONDARY SLUDGE HOPPERS - APPLICABLE MOE DESIGN CRITERIA

Hopper Parameter	Recommended Value
Minimum Wall Slope (Vertical:Horizontal)	1.7
Maximum Base Dimension (m)	0.6

6.3 Process Design Calculations

Detailed process calculations were undertaken during the design of the expanded secondary treatment system to determine appropriate process sizing, aeration demand, and chemical (alum) requirements. These calculations may be found in Appendix C.

Detailed modelling of the extended aeration process (including sedimentation) was performed using ProcessPRO software to confirm the results of the process design calculations. Model input and output are attached (Appendix D). An electronic copy of the base model has also been included with this submission for use and evaluation by the MOE.

6.4 Process Design Summary

6.4.1 Aeration

Table 20 summarizes the proposed design of the new extended aeration basins. The configuration and sizing of the basins were based on process design calculations, available footprint, and consideration of the potential for future expansion.

TABLE 20: AERATION BASINS – DESIGN SUMMARY

Basin Parameter	Value
SWD (m)	4.6
Freeboard (m)	1.0
No. Treatment Trains	2
Basin Width (m)	6.9
Basin Length (m)	28.0
Length:Width	4:1
Total Volume of Aeration Basins (m^3)	1,777
Volume per Basin (m^3)	888

The results of process design calculations for the new extended aeration system are presented in Table 21.

TABLE 21: EXTENDED AERATION SYSTEM – PROCESS DESIGN SUMMARY

Process Parameter	Value
Average Organic Loading Rate (kg BOD_5/(m^3d))	0.16
Peak Organic Loading Rate (kg BOD_5/(m^3d))	0.30
F/M (d^{-1})	0.07
HRT at AADF (h)	25.6
RAS Rate (% AADF)	50 - 200
SRT (d)	18
MLSS Concentration (mg/L)	3,000
Average Oxygen Requirement (kg/d)	1,820
Average Air Flow Requirement (m^3/min)	18.1

6.4.2 Sedimentation

Table 22 summarizes the proposed design of the new secondary clarifiers. The configuration and sizing of the clarifiers were based on process design calculations, available footprint, and consideration of the potential for future expansion.

TABLE 22: SECONDARY CLARIFIER – DESIGN SUMMARY

Basin Parameter	Value
SWD (m)	4.5
Freeboard (m)	1.0
No. Treatment Trains	2
Total Clarifier Surface Area (m^2)	196
Area per Clarifier (m^2)	98
Clarifier Width (m)	4.9
Clarifier Length (m)	20.0
Length:Width	4:1
Width:Depth	1.1:1

The results of process design calculations for the new secondary sedimentation system are presented in Table 23.

TABLE 23: SECONDARY SEDIMENTATION – PROCESS DESIGN SUMMARY

Process Parameter	Value
Maximum Solids Loading Rate (kg /(m^2d))	102
Maximum Surface Overflow Rate (m^3/(m^2d))	33
Effluent Weir Length (m)	54
Effluent Weir Loading Rate at PHF (m^3/(md))	123

Table 24 summarizes the proposed design of the secondary sludge hoppers. The configuration and sizing of the hoppers were based on MOE design criteria.

TABLE 24: SECONDARY SLUDGE HOPPER – DESIGN SUMMARY

Hopper Parameter	Value
Wall Slope (Vertical:Horizontal)	1.7
Base Dimension (m)	0.6

6.4.3 Chemical Dosing

Alum will be dosed to the aeration basins and secondary clarifiers to aid in phosphorus removal during secondary treatment. Alum precipitates soluble phosphorus and results in floc formation to facilitate the settling of particulate phosphorus and other solid material.

Currently, commercial-grade alum is dosed at a rate of 0.174 L/(m^3d) to the existing secondary treatment system. At the design average day flow of 2,874 m^3/d, this is equivalent to an alum flow rate of 42 L/h. Of this, 18 L/h would be dosed to the existing secondary treatment system and 24 L/h would be injected into the new secondary treatment system. The existing alum dosing system comprises only two pumps, each rated at 8 L/h. This is inadequate to meet the alum dosing requirements of the expanded plant. Four additional pumps (3 duty, one standby, each with a capacity of 20 L/h) will be incorporated into the manifold as part of the plant expansion. Alum will also be injected to the tertiary treatment system and sludge handling system.

Typical alum dosages required for phosphorus removal suggest that a much lower dosage would suffice. It is recommended that jar-testing be performed after construction of the WWTP expansion to optimize chemical usage at plant.

6.5 Description of Proposed Works

The new secondary treatment facilities will consist of two aeration basins, two rectangular clarifiers and associated return/waste/scum pumping facilities. The aeration basins will contain a four-zone fine pore aeration system. Slide gates will be used on the aeration basin inlet to permit isolation of either treatment train for maintenance. Effluent from the aeration basins will flow over a weir into a common channel. If needed, the channel will permit discharging both aeration basins into a single clarifier to allow for clarifier maintenance or repair. Two 500- millimeter (mm) diameter pipes connect each clarifier to the common channel; sluice gates will be used to shut off flow to the clarifiers.

The new secondary clarifiers will use a chain and flight sludge collector and have launders for collecting clarified water. A plant effluent water hydrant will be located to permit flushing of the

launders. Inlet baffles will be used to evenly distribute the flow throughout the clarifiers. A common scum sump will be located adjacent to the new clarifiers; a scum pipe will convey scum to this sump. Platforms also will be provided to permit access to valves, instruments, motors and other equipment in the clarifier and aeration basins. The return activated sludge (RAS) and waste activated sludge (WAS) pumps will be located in a dry well between the aeration basins and clarifiers.

The existing blowers will be used to provide air to the existing aeration basin. Two new blowers with VFDs, located in a new structure between the new aeration basins and clarifiers, will be used to supply air to the existing and new secondary aeration basins.

7.0 TERTIARY TREATMENT SYSTEM DESIGN

7.1 Design Basis

The existing tertiary filtration system will be decommissioned and effluent from both the existing and new secondary treatment systems will be combined for treatment in the new two-stage tertiary treatment system. Design flows for the new tertiary treatment system are equal to design flows for the expanded WWTP.

Design influent wastewater quality was based on historical secondary treatment performance. Data showed secondary effluent phosphorus concentrations ranging from 0.109 to 0.360 mg/L, and TSS concentration ranging from 3.4 to 15.1 mg/L. Values of 0.7 mg/L and 30 mg/L for TP and TSS respectively were used in the design of the tertiary treatment system, which are approximately twice the maximum measured TP and TSS concentrations. Table 25 lists these criteria, as well as tertiary effluent criteria as established during the assimilative capacity assessment.

TABLE 25: TERTIARY TREATMENT – DESIGN CONTAMINANT CONCENTRATIONS

Parameter	Secondary Effluent (mg/L)	Tertiary Effluent (mg/L)
Total Phosphorus	0.7	0.1
Total Suspended Solids	30	5

7.2 MOE Design Criteria

During the Class EA, it was determined that the existing filtration system would not reliably achieve new effluent phosphorus limits. The new filtration system will comprise upflow, continuous backwash sand filters arranged in a two-stage configuration.

Section 15.2 of the Design Guidelines for Sewage Works discusses design, construction, and operational considerations related to high rate effluent filtration processes. Table 26 summarizes process design recommendations for deep bed (1-2 m) filters.

TABLE 26: FILTRATION – APPLICABLE MOE DESIGN CRITERIA

Process Parameter	Value
Maximum Hydraulic Loading at PHF, including backwash ($L/(m^2s)$) [1]	3.3
Peak Solids Loading ($mg/(m^2s)$) [2]	83
Maximum Filter Backwash Rate (% AADF)	15

1 $L/(m^2s)$ refers to the hydraulic loading rate to each square metre of filtration area.

2 $mg/(m^2s)$) refers to the mass loading of solids to each square metre of filtration area.

7.3 Process Design Calculations

Detailed process calculations were undertaken during the design of the new tertiary treatment system to determine appropriate process sizing and chemical (alum) requirements. These calculations may be found in Appendix E.

7.4 Process Design Summary

7.4.1 Filtration

Table 27 summarizes the proposed design of the new tertiary filter cells. The configuration and sizing of the cells were based on process design calculations and available footprint, as well as recommendations from the filter manufacturer.

TABLE 27: FILTER CELLS – DESIGN SUMMARY

System Parameter	Value
No. Treatment Trains	4
No. First Stage Filter Cells	8
No. Second Stage Filter Cells	8
No. Modules per Cell	2
Total Filtration Area per Stage (m^2)	37.2
Filtration Area per Cell (m^2)	9.3
First Stage Media Depth (m)	2
First Stage Media Size (mm)	13
Second Stage Media Depth (m)	1
Second Stage Media Size (mm)	9

The results of process design calculations for the new tertiary treatment system are presented in Table 28.

TABLE 28: FILTRATION – PROCESS DESIGN SUMMARY

Process Parameter	Value
Backwash Flow per Module (L/s)	0.44 – 0.88
Hydraulic Loading at PHF (L/(m^2s))	3.96
Hydraulic Loading at MDF (L/(m^2s))	2.82
Hydraulic Loading at AADF (L/(m^2s))	2.17
Peak Solids Loading (mg/(m^2s))	65

7.4.2 Chemical Dosing

Alum Dosing for Phosphorus Removal

Alum will be injected into the tertiary influent mixing chamber for phosphorus removal during tertiary treatment. Typically, a ratio of 28 L alum (commercial-grade) per kg P of phosphorus to be removed is applied to estimate alum requirements in the absence of historical plant data or jar-testing results. Assuming a maximum influent total phosphorus concentration of 0.7 mg/L and an

effluent objective of 0.1 mg/L, the required alum dosage rate under AADF conditions is 48.16 L alum/d (2.01 L/h).

It is recommended that jar-testing be performed after construction of the WWTP expansion to optimize chemical usage at plant.

Polymer Dosing for Reject Thickening

The manufacturer of the NoPhos P2000 filtration system recommended a polymer dosage of 1 – 2 ppm upstream of the lamella clarifier to aid in the settling of filter backwash solids. Assuming a polymer dosage of 2 ppm at the maximum anticipated filter backwash rate, the peak neat polymer flow rate is estimated at 0.29 L/h. Assuming dilution to 0.25 percent, the required dilution flow water flow rate is about 115 L/h.

Polymer will also be injected into sludge generated in the lamella clarifier to prior to thickening in the gravity settlers. The EPA's Gravity Thickening Fact Sheet (1987) gives a typical polymer dosage of 2.5 – 6 g active polymer per kg of dry solids for gravity sludge thickening. Based on estimations of the dry solids mass of lamella sludge and assuming a polymer dosage of 6 g/kg, the required neat polymer flow rate is 0.18 L/h. Assuming dilution to 0.25 percent, the required dilution flow water flow rate is about 72 L/h.

A polymer dosing system will be installed in the new tertiary treatment building.

7.5 Description of Proposed Works

Flow from the existing and new secondary treatment system will be combined in the new UV/tertiary treatment building. The pipe from the new clarifiers will be sized to handle two future clarifiers of the same size. This UV/tertiary treatment building will house the tertiary treatment facilities, which will consist of a two-pass, upflow, continuous backwash sand filtration system designed to accomplish phosphorus and TSS removal. Four two-module filter cells will comprise each filtration stage, for a total of sixteen filter modules.

Secondary effluent will be dosed with alum in a mixing chamber before entering the filter beds, where flocculation will occur. Filter influent will enter near the bottom of the filter beds and will flow upward. Filtrate from the first-stage filters will flow over an effluent weir near the top of the modules and into the second-stage filters. From the second stage filters, effluent will be conveyed to the new UV disinfection system. Filter reject (wastewater from the continuous backwash of the filters) will flow to a sump, from which it will be pumped to a Lamella gravity

settler. The supernatant from the clarifier will flow by gravity to the filter influent channel. There also will be a bypass to the head of the new aeration basins should the gravity settler be under maintenance. Sludge from the Lamella gravity settler will be pumped to the new sludge thickeners.

Two polymer feed systems will be installed in the UV/tertiary treatment building: one to facilitate solids settling in the Lamella Gravity Settler, and one for conditioning clarifier sludge prior to thickening.

8.0 DISINFECTION SYSTEM DESIGN

8.1 Design Basis

Table 29 summarizes the information provided to the manufacturer for the design of the UV disinfection system. The maximum influent TSS concentration assumes failure and bypass of the tertiary treatment system. It is intended that the new UV disinfection system have the capability to be expanded to the proposed future peak design flow without modifications to the concrete channels. The maximum effluent E. coli concentration is as required by the MOE.

TABLE 29: UV DISINFECTION – DESIGN BASIS

Parameter	Value
Current Design Peak Flow (m^3/d)	11,496
Future Peak Flow (m^3/d)	20,000
Maximum Influent TSS (mg/L)	30
Effluent E. coli Concentration (CFU/100 mL)	200
Redundancy (%)	100

Additional design criteria established by the manufacturer are shown in Table 30.

TABLE 30: UV DISINFECTION – MANUFACTURER'S DESIGN PARAMETERS

Parameter	Value
Minimum UV Transmittance (%)	65
Design UV Dose (μWs/cm^2) [1]	36,000
End of Lamp Life Factor	0.98
Fouling Factor	0.95

1 μWs/cm^2 refers to energy dosed to each square centimetre of the vertical cross-sectional area of the wastewater flow path.

8.2 MOE Design Criteria

Section 14.4 of the Design Guidelines for Sewage Works briefly discusses design and operation of ultraviolet units for disinfection of municipal wastewater treatment plant effluent but does not provide specific design criteria. Because UV disinfection systems are proprietary, critical parameters for UV disinfection units are difficult to generalize; these are dependent upon manufacturers' design, lamp selection, tube materials, etc.

The guidelines note that current procedure is for the UV system to be designed to deliver the required UV dose at peak flow, and recommend that the UV dosage should be based on the design peak hourly flow.

8.3 Process Calculations

Process design calculations were performed by the manufacturer of the UV disinfection system based on the specifications prepared by Consulting Ltd. to determine appropriate sizing for the disinfection system, lamp type and number, etc. These calculations are considered proprietary and are not available for review.

8.4 Design Summary

Table 31 lists selected characteristics of the UV disinfection system.

TABLE 31: UV DISINFECTION SYSTEM – DESIGN SUMMARY

Parameter	Value
Number of Channels	2 (1 duty, 1 standby)
Channel Length (m)	9
Channel Width (mm)	914.4
Channel Depth (mm)	1168.4
Total Number of Banks	4
Number of Modules per Bank (Current)	5
Number of Modules per Bank (Future)	9
Number of Lamps per Module	4
Total Number of UV Lamps (Current)	40 (duty)
Total Number of UV Lamps (Future)	72 (duty)
Maximum Power Draw (kW) (Current, w/o Redundancy)	10
Maximum Power Draw (kW) (Future, w/o Redundancy)	18
Type of Level Controller	Fixed Weir
Weir Length (m)	19.46

8.5 Description of Proposed Works

The new UV disinfection system will contain a total of four new UV banks split between two channels to permit 100 percent redundant operation at peak design flow. Each channel also contains a width reduction baffle, which may be removed in the future to allow the installation of additional UV modules and increase the capacity of the disinfection system to 20,000 m^3/d. The existing UV channel will be demolished following construction and commissioning of the new UV treatment system.

9.0 SLUDGE HANDLING SYSTEM DESIGN

9.1 Design Basis

9.1.1 Gravity Thickening

Table 32 presents the basis established for the design of the gravity thickeners.

TABLE 32: GRAVITY THICKENING – DESIGN BASIS

Parameter	Value
Wastewater AADF (m^3/d)	2,874
Secondary Solids Production (kg/d)	540
WAS Concentration (%)	0.07
WAS Polymer Addition (kg/d)	negligible
Peak Lamella Solids Removal (kg/d)	288
Lamella Sludge Concentration (%)	1
Lamella Sludge Polymer Addition (kg/d)	negligible
Total Solids Loading to Thickeners (kg/d)	828

9.1.2 Sludge Storage

Table 33 presents the basis established for the design of the aerated holding tank. It was assumed that gravity thickener underflow concentration would be at least 2 percent and 5 days of storage should be provided for sludge at this concentration. If the solids concentration of sludge is greater than 2 percent, available sludge storage will be greater than 5 days.

TABLE 33: SLUDGE STORAGE – DESIGN BASIS

Parameter	Value
Minimum Thickened Sludge Concentration (%)	2
Storage Time (d)	5

9.2 MOE Design Criteria

During the Class EA, construction of new sludge handling facilities was recommended. During the ESR addendum it was established that the design and installation of simple gravity thickeners and an aerated sludge holding tank was the preferred solution for sludge handling at the ACME WWTP.

Section 17.3.2 of the Design Guidelines for Sewage Works discusses the design of gravity sludge thickeners. Table 34 summarizes recommended design criteria.

TABLE 34: GRAVITY THICKENING – APPLICABLE MOE DESIGN CRITERIA

Parameter	Value
Tank Shape	Circular
SWD (m)	3 – 3.7
Maximum Tank Diameter (m)	21 – 24
Floor Slope	2:12 – 3:12
WAS Loading Rate (kg/(m^{2}d)) [1]	12 – 36
Overflow Rate (L/(m^{2}s)) [2]	0.19 – 0.38

1 kg/(m^{2}d) refers to the loading rate of sludge solids to each square metre of surface area of the gravity thickeners.

2 L/(m^{2}s) refers to the flowrate of supernatant per square metre of surface area of the gravity thickeners.

The guidelines do not directly address the design of aerated sludge holding tanks, although the mixing requirement of 0.5 L/(m^{3}s) given for aerobic sludge digestion in Section 16.3.4 of the guidelines was applied to the design of the sludge holding tank.

9.3 Process Calculations

Detailed process calculations were undertaken during the design of the new sludge handling system to determine appropriate process sizing and chemical (polymer) requirements. These calculations may be found in Appendix F.

9.4 Process Design Summary

9.4.1 Gravity Thickening

Table 35 lists selected characteristics of the gravity thickening system.

TABLE 35: GRAVITY THICKENING – DESIGN SUMMARY

Parameter	Value
Tank Shape	Circular
Total Thickener Surface Area (m^2)	31.8
Surface Area per Thickener (m^2)	15.9
SWD (m)	3.3
Freeboard (m)	0.75
Tank Diameter (m)	4.5
Floor Slope	1:1
Average Sludge Loading Rate (kg/(m^2d))	24
Overflow Rate (L/(m^2s))	0.20

9.4.2 Chemical Dosing

Polymer will also be added to WAS from the existing and new secondary treatment systems prior to thickening in the gravity settlers to increase the settleability of suspended solids. The EPA's Gravity Thickening Fact Sheet gives a typical polymer dosage of 2.5 – 6 g active polymer per kg of dry solids for gravity thickening of WAS. Based on a maximum WAS flow rate of 13 L/s and an estimated sludge solids content of 0.7 percent, the peak neat polymer flow rate is 4.9 L/h. Assuming dilution to 0.25 percent, the required dilution flow water flow rate is about 1,960 L/h. Note that sludge wasting, and therefore dosing, is not constant.

Two polymer dosing systems will be installed in the new sludge handling building.

9.4.3 Sludge Storage and Transfer

Table 36 lists selected characteristics of the aerated sludge holding tank.

TABLE 36: SLUDGE STORAGE – DESIGN SUMMARY

Parameter	Value
Tank Length (m)	13.8
Tank Width (m)	7.1
SWD (m)	2.5
Freeboard (m)	1
Tank Volume (m^3)	245
Storage Time (d)	5.8
Floor Slope	1:12
Aeration ($L/(m^3s)$)	0.68

9.5 Description of Proposed Works

Sludge handling at the expanded ACME WWTP will consist of thickening prior to storage in an aerated holding tank. Sludge and clarifier scum will be transferred to a tanker truck for offsite treatment and disposal. A new sludge loading station will be located on the east side of the new sludge handling building. Sludge handling facilities for the existing and new treatment modules will be consolidated into a single facility to allow transfer to the new tanker truck transfer station. WAS from the new secondary treatment system will be pumped to two new thickeners. Wasting of sludge for the existing clarifier will be conveyed to the existing aerobic digester as per current operation. The digested sludge will be pumped to the new thickeners. The existing sludge loading pump will be replaced to meet the hydraulic requirements to convey sludge to the new location. A spare pump will be furnished. In addition, underflow from the new Lamella gravity settler will be pumped to the thickeners.

Polymer feed facilities will be provided in the sludge handling building to facilitate thickening. Polymer drums will be used for storage. Two package blending units will be used to dilute and age the polymer prior to in-line injection into the thickener influent piping. In addition, a new eyewash/shower facility will be installed adjacent to the polymer feed system.

The new thickeners will be designed using a manifold to allow one unit to fill while the other unit is settling, decanting and draining. Once one thickener becomes full, decant will start and filling will be switched to the other thickener so as not to disrupt sludge wasting. Telescopic decanters will be used to remove supernatant, which will be discharged to the existing headworks building downstream of the grit chambers.

Thickened sludge will drop by gravity to the aerated holding tank below. Coarse bubble aeration will be provided in the holding tank to maintain solids suspension and reduce the potential for pump clogging. Two new blowers will be installed in the dry well of the sludge handling building. These blowers will supply the holding tank diffusers. The blowers also will be used to supply a new air header for the existing headworks building channels to maintain grit and scum in suspension.

Two positive displacement gear pumps will be used to convey sludge from the holding tank to the new tanker truck loading station. An overhead fill port will be used to fill the tanker from its top hatch and minimize spillage. A drain valve will be used to permit the fill port to drain back to the sludge holding tank. Flushing connections will be provided on the sludge lines.

10.0 PLANT HYDRAULIC PROFILE

10.1 Hydraulic Profile Calculations

An analysis was performed to develop the theoretical hydraulic profile of the expanded WWTP under design peak hour flow conditions. The profile shows changes in water surface elevation from the flow distribution chamber to the plant outfall, as well as the elevations of all major unit processes, weirs, channels, and conduits. Hydraulic analysis was important in the selection of pipe size and layout/configuration, weir design, and equipment selection and design. The ACME WWTP has been designed to accommodate the design PHF without anticipated overflows and with enough remaining head to permit uninterrupted discharge to the Anytown River at the maximum (100-year) river surface elevation.

Detailed calculations may be found in Appendix G, and drawings C-16, C-17, and C-18 in the detailed design drawings set provide detailed illustrations of the profile. Table 37 lists theoretical water surface elevations at selected points in the wastewater treatment process.

TABLE 37: SELECTED WATER SURFACE ELEVATIONS AT PEAK HOUR FLOW

Location	Water Surface Elevation (m)
Humber River Max. WS Level (100-Year)	175.800
Required Plant Effluent Head	175.800
Manhole 2 Max WS Elevation	175.821
Manhole 1 Max WS Elevation	175.855
UV Channel Operating Level	176.281
Filter 2 Operating Level	176.493
Filter 1 Operating Level	177.539
Mixing Tank WS Elevation	178.505
Secondary Clarifier Operating Level (NEW)	178.915
Secondary Clarifier Operating Level (EXISTING)	178.749
Aeration Basin Operating Level (NEW)	179.060
Aeration Basin Operating Level (EXISTING)	178.947
Flow Distribution Chamber WS Elevation	180.051

10.2 Hydraulic Modelling

Hydraulic modelling was performed to confirm the results of the hydraulic analysis. LevelPRO hydraulic modelling software was used. Model input and output are attached (Appendix H). An electronic copy of the base model has also been included with this submission for use and evaluation by the MOE.

11.0 ARCHITECTURAL DESIGN

The WWTP expansion project will involve the construction of three new buildings:

- Tertiary Treatment/UV Building (adjacent to Main Building);
- RAS/WAS Structure; and the
- Sludge Handling Building (adjacent to Headworks Building).

11.1 RAS/WAS Structure

The RAS/WAS Structure is located between the new aeration basins and clarifiers, and has interior dimensions of approximately 5 m wide by 22.5 m long. Below grade, this structure houses the return and waste activated sludge pumps, as well as ancillary piping and valves. The second floor of the RAS/WAS structure holds an electrical room and two aeration blowers. An access hatch in the floor will permit the removal of pumps from the lower level. Operator access will be provided by stairs located on the north and south ends of the structure.

The architectural style of the above-ground portion of the structure will match that of other WWTP buildings.

11.2 Tertiary Treatment/UV Building

The tertiary treatment/UV building is located near the west boundary of the site adjacent to the existing main building. The building will house the tertiary filters and associated equipment, including the lamella gravity settler, as well as the UV disinfection system, plant process water sump, and plant effluent flow meter. An electrical room will also be located in the tertiary treatment/UV building.

The new building will be constructed of block, insulation and face brick, and the architectural style will match the adjacent main building.

11.2.1 Tertiary Treatment

The tertiary filters will be cast-in-place concrete and are situated in the southeast quadrant of the building. The filtration system, including the influent mixing chamber, is approximately 12.5 m wide by 16 m long. The base of the filters extends more than 6 m below grade. At grade access to the filter room is provided by a double-leaf door on the north face of the building, and a single-leaf door on the south face.

The lamella gravity settler will be located below grade just north of the filtration system.

11.2.2 UV Disinfection

The UV disinfection channels extend along the west side of the building. Together, the channels measure approximately 5.75 m wide by 14 m long. The UV disinfection system is accessible through the doors described in the preceding subsection.

11.2.3 Effluent Flow Meter and Electrical Room

Effluent from the UV disinfection system passes through the plant effluent flow meter, located in the northwest quadrant of the building. The electrical room is situated directly above the flow meter chamber and measures approximately 5.75 m wide by 8.3 m long. At grade access to the electrical room is provided by a double-leaf door on the north face of the building.

11.3 Sludge Handling Building

The Sludge Handling Building will contain four rooms: the polymer room, odour control room, gravity thickener room, and dry well, as well as an enclosed aerated sludge holding tank. This building will be located in the northeast corner of the adjacent to the headworks building being constructed as part of the current upgrades project. An electrical room will be constructed in the space between the two buildings.

The new building will be constructed of block, insulation and face brick, and the architectural style will match the adjacent headworks building.

11.3.1 Odour Control Room

The odour control room is situated in the northwest corner of the sludge handling building. The room will contain the in-vessel biofilter and associated appurtenances. The room is approximately 6.75 m wide by 10.5 m wide. At-grade access will be provided using a single-leaf door. A roll-up door will also be furnished to permit removal of odour control system equipment. This room will be located directly over the dry well, and will have an access hatch to permit removal of equipment from the dry well.

11.3.2 Dry Well

The dry well will contain positive displacement gear pumps, holding tank blowers and associated piping. The room is approximately 5.5 m wide by 13.75 m long. Access will be provided via a stairwell originating at ground level in the northwest corner of the building.

11.3.3 Gravity Thickener Room

The gravity thickener room is situated on ground level directly above the sludge holding tank on the east side of the building, and measures approximately 7 m wide by 13.75 m long. The floor supports the gravity settlers, which empty into the sludge holding tank below. A mezzanine floor allows access to the thickeners for decanting and washdown. At-grade access to the gravity thickener room will be provided by doors on both the north and south sides of the room. Stairs originating in the northeast corner of the room provide access to the mezzanine.

11.3.4 Polymer Room

The polymer room is situated in the southwest corner of the sludge handling building and measures approximately 3 m wide by 6.75 m long. The room will house two polymer dosage systems and provide storage for drums of unused neat polymer. A double-leaf door will be provided for at-grade access.

11.3.5 Electrical Room

The electrical room is situated on ground level between the headworks building and the sludge handling building and will contain the electrical switchgear for the sludge handling building. The room is approximately 3 m wide by 9.75 m long. A single-leaf door will be used for at-grade access.

12.0 ELECTRICAL

12.1 Electrical Servicing

The ACME WWTP currently has 600A, 600V, three-phase power service from a 300kVA service transformer located between the Main Building and the Office. The transformer and metering system are owned by the local electrical utility. This transformer will be upsized to 1,000kVA, 27.6kV:600/347V, three-phase to accommodate the increased power requirement of the expanded facility and relocated to permit extension of the access road. The power service upgrade and utility transformer relocation requirements have been coordinated with the local electrical utility. The service transformer will be owned by the utility and will be located on the ACME WWTP property. The local utility will supply and install the following:

- a utility service hydro pole with fused cutouts and lightning arresters;
- a 1,000kVA three-phase primary service transformer;
- the primary cables from hydro pole location to transformer vault via concrete encased duct provided by the Electrical Contractor; and
- a secondary metering system complete with hydro meter installed in the metering cabinet.

The utility metering transformers will be installed in the metering compartment at the proposed 2,500A, 600V, 3-phase service entrance and power distribution switchgear located in the Main Building. Secondary cables sized accordingly to the future transformer capacity will be connected to the 2,500A frame service entrance rated circuit breaker located in new service switchgear.

The existing MCC-A will be maintained to operate the facilities being constructed under the current upgrades project. The new UV system will also be powered from the existing MCC-A, which will be modified as part of the WWTP expansion project. MCC-A is fed from an existing 400kVA standby emergency generator during a power outage. MCC-B, located in the new headworks building, will not be modified.

A new MCC-C will be located in Main Building to power the expanded secondary treatment facilities. A new MCC-D will serve the sludge handling and odour control facilities. The tertiary treatment/UV building will be powered from a new MCC-E. An additional standby generator will be installed to provide power to new MCCs C, D, and E during a power failure.

12.2 Emergency Standby Power

A new 750 kVA standby generator will be installed to support new loads related to operation of the expanded WWTP facilities during main power failure. Existing plant electrical loads and the expanded UV disinfection system will be supported by the current 300 kVA standby generator.

An uninterruptable power supply will be installed in the new control panel to provide a short-term power supply (approximately 20-minutes) to PLC controller, instruments, and communication devices in the interim period between power failure and full-capacity generator operation.

13.0 INSTRUMENTATION AND CONTROL

13.1 SCADA System

The ACME WWTP has an existing SCADA system. Instrumentation and control of the expanded facilities, as well as changes to interface the new and existing treatment modules, will be incorporated into the current SCADA system.

13.2 Process Narrative

A process narrative describing instrumentation and control for each major process was prepared and may be found in Appendix I. The narrative also describes process inter-relationships and interfacing with existing WWTP facilities.

14.0 MITIGATION OF CONSTRUCTION IMPACTS ON PLANT OPERATION

The modular approach to the expansion of the secondary treatment system will serve to minimize construction impacts on the operation of the existing WWTP. Most of the new facilities, including the aeration basins, secondary clarifiers, and RAS/WAS structure will be constructed with little impact on existing operations, but in some cases careful planning is necessary to maintain plant operation during construction.

14.1 Construction of the new Tertiary Treatment/UV Building

The new building will be constructed adjacent to the existing Main Building, and will overlap the location of the existing UV system. Special construction methods, such as sheeting and underpinning will be employed to allow the new building to be constructed without impacting the foundation of the existing structure.

The tertiary treatment/UV building will be constructed in two phases to allow for continuous UV disinfection. The new UV channels will be constructed first and temporarily connected to the existing filter effluent and outfall piping. The new UV system will be installed and tested while the existing UV channel remains available. Once the new UV system is commissioned, the existing UV channel will be demolished and construction of the tertiary treatment component of the building will proceed.

14.2 Construction of the New Sludge Handling Building

The new building will be constructed adjacent to the Headworks Building being constructed under the current upgrades project. Special construction methods, such as sheeting and underpinning will be employed to allow the new building to be constructed without impacting the foundation of the existing structure. Because of their proximity, a shared roof will be constructed to disguise the two buildings as a single structure. The existing roof will remain in place to protect the interior of the headworks building during construction.

14.3 Installation of New Flow Distribution Chamber

The new flow distribution chamber will be installed in the existing 400 mm pipe to the existing secondary treatment facility. Bypass pumping will be employed to maintain flow to the existing aeration tank while the new chamber is installed. The pumping system will be designed to handle

current design peak flows and will be fully redundant for protection in the event of a pump failure.

14.4 Installation of New Outfall Piping

The existing 300-mm outfall piping will be removed and replaced with 600-mm pipe. Bypass pumping will be employed to maintain flow to the Anytown River during installation of the new piping. The pumping system will be designed to handle current design peak flows and will be fully redundant for protection in the event of a pump failure.

14.5 SCADA Programming

The existing SCADA system will need to be re-programmed to include operation of the expanded portions of the plant. To mitigate any impacts on the operation of the existing plant, a copy of the existing SCADA program will be modified and debugged off line. Once complete, a second processor will be temporarily used to "live test" the program and complete debugging. During this test, the existing program will remain available for use as a backup should the need arise.

14.6 Relocation of Power Service

The power service and transformer will be relocated to allow the construction of the new plant access road, but the existing service must be maintained during construction to allow uninterrupted wastewater treatment. The power service will be installed and connected to the new facilities. The existing power service will remain until the expanded portions of the WWTP are constructed, tested and commissioned. Once the new facilities are operational, the existing portions will be operated using the standby power generator. The existing transformer will be removed, and power supply to the existing MCC will be relocated to the new transformer.

14.7 Installation of Secondary Clarifier Effluent Piping

Secondary clarifier effluent will need to pass between the existing clarifier and Main Building to allow conveyance to the new tertiary treatment system. Hand excavation of this pipe has been specified to protect the existing piping and conduits.

15.0 ENVIRONMENTAL CONSIDERATIONS DURING CONSTRUCTION AND OPERATION OF THE EXPANDED WWTP

15.1 Site Geotechnical Evaluation

A geotechnical investigation was performed to evaluate the subsurface conditions at the WWTP site (Appendix J). Boreholes were drilled at seven locations corresponding to the proposed locations of the Tertiary Treatment/UV Building, RAS/WAS Structure, Sludge Handling Building, aeration basins and secondary clarifiers. Conclusions and recommendations included in the report are based on the results obtained from analysis of these samples.

The report contains a description of the findings of the geotechnical investigation, as well as professional opinions and recommendations regarding subsurface conditions, design and construction of building foundations and floor slabs, and pavement design for the new access road. The anticipated construction conditions pertaining to excavation, temporary groundwater control and backfilling are also discussed, but only with regard to how these might influence the design.

Some report findings are summarized below:

- The shallow earth fill and native soils are considered suitable for reuse as backfill to raise site grades where required.
- The existing fill is generally suitable to remain in place to support engineered fill placement, floor slabs, and pavement structures.
- Building foundations at the site should consist of conventional spread footings or augered piers founded on the native soils. No adverse soil conditions were encountered on the site that would result in the need for deepened footings.
- Some groundwater seepage will be encountered during shallow excavation activity and dewatering will be required.
- Undisturbed native soils or engineered fill will provide adequate support of buried services.
- Backfilling of trenches can be accompanied by reusing excavated soils or similar fill material. The fill material and shallow native till encountered on the site were considered suitable for reuse in the site.
- Based on the type and frequency of traffic that is anticipated for the site, a 19 mm base course (200 mm depth) and a 50 mm subbase course (300 mm depth) were recommended for the design of the proposed access road.

It is emphasized that the conclusions and recommendations are based on the characteristics observed at the boreholes locations only. If during constructions any conditions are encountered that differ from those observed at the test locations, reassessment may be necessary.

15.2 Surface Water Impacts

To minimize adverse impacts on surface water quality during construction, stockpiled materials, excavated soils, and demolition debris will be secured to mitigate the risk that loose materials could be washed or floated away and enter the Anytown River via surface run-off. Discharge from dewatering systems will pass through sedimentation ponds before discharge to the Anytown River via the WWTP outfall. If the discharge water has a high solids content, additional stilling basins will be installed, or the water may be discharged to the WWTP for treatment. Additionally, an erosion and sedimentation control plan has also been developed and will be implemented all phases of construction to minimize effects on surface water quality. Demolition debris will be removed promptly from the site and disposed of in accordance with applicable laws and regulations.

All oils, lubricants, fuels and chemical products will be stored in secure areas to prevent their accidental release into the environment. Accidental spills and leaks will be captured, contained and cleaned up immediately and reported as required to the MOE's 24-hour spill hotline (see Section 17.1). There will be an adequate supply of appropriate clean-up materials on site and all construction personnel will be fully trained on their use.

A procedure has been developed to mitigate impacts on the operation of the existing WWTP during construction. The ACME WWTP will remain fully operational and effluent produced at the plant during construction will comply with the requirements of the existing C of A. The expanded WWTP will continue to discharge treated effluent to the Anytown River. The expanded plant has been designed and will be operated to meet revised effluent limits, developed based on the results of the assimilative capacity evaluation and in consultation with the MOE. Effluent limits have been selected to minimize the impact of the ACME WWTP discharge on surface water quality and aquatic organisms in the Anytown River.

The Anytown River floodline encroaches upon a portion of the WWTP property. No permanent or temporary facilities will be constructed within the floodplain to minimize the risk of damage to wastewater treatment infrastructure and the potential for release of untreated wastewater to the river during flooding. The Anytown River Valley Conservation Authority (ARVCA) has been consulted and a permit has been obtained for work on the river bank during replacement of the effluent line and relocation of the plant outfall.

15.3 Groundwater Impacts

The ARVCA expressed concern about the potential impact of groundwater dewatering on the water-bearing sands at the site and surrounding areas. Analysis of geotechnical characteristics of the site and surrounding areas suggest that the zone of influence from construction dewatering would not extend eastward beyond the ridge. Pumping from the site will not affect groundwater levels on the west site of the Anytown River. There are no known water supply wells below the ridge which derive their water from the alluvial deposits from which water will be removed during construction, therefore no impact on existing groundwater users is expected. Regardless, groundwater isolation techniques will be implemented to minimize the loss of groundwater from the permeable soil layer at the WWTP site. Groundwater that is removed from the excavations will be addressed using the surface water quality control measures outlined in Section 15.2.

Substructures for the expanded facilities have been designed to handle hydrostatic uplift pressures based on seasonally high groundwater levels. Therefore, groundwater drainage systems will not be required.

15.4 Air Impacts

Material handling related to excavation, demolition, loading, and hauling typically generates significant amounts of dust during construction activities. During construction of the WWTP expansion, dust control measures will be implemented. These mitigation measures may include, but are not limited to, using appropriate dust suppression measures such as spraying down the site and roadways, limiting excavation on windy days, washing trucks and using dust covers on haulage trucks. Construction activities are not expected to create quantities of dust that will exceed acceptable MOE guidelines.

To prevent air quality impacts associated with construction vehicle exhaust fumes, emission control devices and equipment will be functional and effective, and new or well-maintained heavy equipment and machinery, preferably fitted with muffler/exhaust system baffles and engine covers will be used.

To minimize the impact of the release of designated substances to the air if one or more of these substances is encountered during demolition work, a Designated Substances Survey has been prepared and includes recommendations for appropriate mitigation measures.

15.5 Social Environment Impacts

15.5.1 Noise

A short-term increase in on-site noise levels from construction activities will occur in the immediate area of the construction. However, sound levels at the nearest property boundary are expected to be well below MOE noise level limits. Construction activities will also be restricted to hours prescribed by the local noise by-law. Ensuring that equipment is in proper working order and using noise attenuation devices (mufflers on motorized equipment) will ensure compliance with government requirements and will result in sound levels being within acceptable levels both on and off site. Although these recommended mitigation measures will be effective at minimizing the likely environmental effects due to construction-associated noise, minimal residual localized effects may result.

An acoustic assessment of the operation of the existing facility found that the unattenuated steady-state sound levels at the nearest points of reception (PORs) are below the MOE's minimum exclusionary nighttime sound level limits. Future equipment must contribute less than 30 dBA at the PORs. The expansion project will incorporate several additional pieces of mechanical equipment. Of greatest concern with respect to noise generation are new pumps and blowers. Measures to mitigate noise impact from this equipment will include installation in below-grade structures, the use of noise-reducing covers, and installation of sound-deadening materials in buildings. It is anticipated that sound levels at the PORs will remain below the maximum acceptable level.

15.5.2 Visual Aesthetics

The WWTP expansion will involve the construction of several new buildings and other structures. The new buildings will be designed to match the architectural style of the existing Main Building and the headworks building currently under construction. Trees and other landscaping elements will be used as required to screen the facility to the extent possible.

15.5.3 Odour

MOE Guideline D-2, *Compatibility between Sewage Treatment and Sensitive Land Use,* specifies separation distances intended to mitigate the effects of offensive odours which may occur during normal operations or when facilities have minor overloads or upsets created by abnormal conditions or sludge processing/handling. Where an adequate buffer cannot be provided,

technical mitigation procedures may be necessary to provide protection to sensitive land uses. For wastewater treatment plants with a rated capacity between 500 and 25,000 m3/d, the recommended separation distance is 150 m, and the required separation distance is not less than 100 m.

The distance between the ACME WWTP and the nearest sensitive receptor is less than 100 m, therefore odour control is required. Odour control is not currently provided at the plant; an odour control system was designed and will be installed as part of the expansion project. Section 16 describes the design of the odour control system.

16.0 ODOUR CONTROL

Where an adequate buffer distance for odour mitigation cannot be provided, technical mitigation procedures are necessary to provide protection to sensitive land uses. The distance between the ACME WWTP and the nearest sensitive receptor is less than 100 m, therefore odour control is required. Odour control is not currently provided at the plant and odour complaints are not common, but increased wastewater flows may increase the potential for off-site odour impacts.

16.1 Odour Sources

Headworks and preliminary treatment operations have a high potential for emission of nuisance odours because influent wastewater has a high sulphide content and turbulence promotes sulfide stripping. Solids handling and treatment processes are also significant sources of odour (Design Guidelines for Sewage Works). Odour emissions from other sources such as aeration basins and secondary clarifiers are relatively low.

At the ACME WWTP, the proposed odour control system will treat odourous air from the headworks building, the gravity thickeners, and aerated sludge holding tank.

16.2 Odour Control Design Basis

16.2.1 Air Flow

A review of design drawings for the current WWTP upgrades project indicates that the screens, grit chamber, and screenings press will be enclosed to minimize the release of odour to the room atmosphere. During the WWTP expansion, a fan will be connected to these enclosures and suction will be applied to induce a slight negative pressure beneath the enclosures to prevent the escape of odour to the room atmosphere. Required headworks air flow rates were determined based on typical surface exhaust rates and, in the case of the aerated grit chamber, process influent air flow rates. Table 38 summarizes design odourous air flow rates from the headworks facilities.

TABLE 38: ODOUR CONTROL SYSTEM – HEADWORKS AIR FLOWS

Unit Process(es)	Air Flow Rate (m^3/min)
Influent Channels, Bar Screens, Vortex Grit Units	5.5
Aerated Grit Chamber	2.0

The required exhaust rate from the aerated sludge holding tank is dependent on the influent air flow rate. The aeration system was designed for a mixing requirement of 0.5 L/(m^3s). At capacity, this equates to an influent air flow rate of 7.3 m^3/min. To ensure a slight negative pressure in the holding tank headspace, an odourous air flow rate of 7.5 m^3/min was selected.

The gravity thickeners will not be enclosed, i.e. the wastewater surface will be exposed to the room atmosphere. In this case, all air in the room must pass through the odour control system. Odourous air flow is therefore determined by ventilation requirements. The rate of air flow from the gravity thickener room to the odour control unit will be approximately 5 m^3/min. Air intakes will be strategically located to ensure efficient capture of the most concentrated odour to minimize its impact on ambient air quality within the gravity thickener room.

The minimum design capacity of the odour control unit is 20 m^3/min.

16.2.2 Contaminant Concentration

Design contaminant concentrations were established based on the results of an extensive air sampling program completed by Consulting Ltd. at a similar facility, and on recommendations from a report presented at the 2008 WEF/A&WMA Odors & Air Emissions Conference. A comprehensive literature review was also conducted. Table 39 summarizes design contaminant concentrations for the ACME WWTP odour control system.

TABLE 39: ODOUR CONTROL SYSTEM – DESIGN CONTAMINANT CONCENTRATIONS

Parameter	Value (ppm)
Maximum Hydrogen Sulfide Concentration	60
Average Hydrogen Sulfide Concentration	20
Maximum Ammonia Concentration	60
Average Ammonia Concentration	20
Total Reduced Sulfur Concentration	5

16.2.3 Odour Concentration

The results of a comprehensive statistical analysis of more than 1000 WWTP odour samples were referenced in the establishment of design influent odour concentration for the ACME WWTP odour control system. A comprehensive literature review was also conducted. The design influent odour concentration was conservatively set at 10,000 odour units (OU)/m^3.

16.2.4 Odour Removal Requirements

The MOE's hydrogen sulfide limit is 13 μg/m^3 at the point of impingement (POI) based on a 10-minute averaging period. The POI refers to the nearest point on the ground or at a receptor (usually a building) beyond the facility's property line where the highest concentration of contaminants resulting from facility emissions is expected to occur. The proposed POI odour concentration limit is 1 OU/m^3, equivalent to the odour detection threshold. This essentially stipulates that plant odour shall be undetectable beyond the plant's property line.

16.3 Odour Emission Modelling

Odour emission dispersion modelling was performed to determine the maximum permissible outlet contaminant and odour concentrations to ensure compliance with MOE requirements. Consulting Ltd. conservatively allowed a maximum POI H_2S (hydrogen sulfide) concentration of 1.4 μg/m^3, well below the odour detection limit.

The air dispersion modelling was performed using ModelAir software. Input parameters are listed below:

- Stack Elevation – 10 m;
- Stack Diameter – 200 mm;
- Receptor height – estimated at 1.5 m, 5m, 10m, and 15m; and
- Receptor location of 85 m (nearest resident) and 125 m.

Model output is attached (Appendix K). A complete Emission Summary and Dispersion Modelling Report was prepared for the odour control system, and is appended to the application for approval (Air & Noise) of the odour control unit.

The maximum allowable emission concentration of H_2S was determined to be 0.4 ppm. Based on the design maximum influent hydrogen sulfide concentration, the odour control system requires a hydrogen sulfide removal efficiency of at least 99.3%.

In addition, assuming an inlet odour concentration of about 10,000 OU/m^3 and 90% removal of total odour through the system, the odour concentration at the receptors was estimated. The 10-minute average odour concentration at all receptors was less than 1 OU/m^3.

16.4 Odour Control Technology

A detailed evaluation of various odour control technologies was performed. Biofiltration was selected as the preferred alternative. Biofiltration is effective in the treatment of many biodegradable, water-soluble contaminants. Odourous gas is passed through a packed media bed and contaminants are adsorbed onto the moist surfaces of the packing material. Microorganisms form a biofilm covering these surfaces and degrade the contaminant compounds, eliminating their odour-causing potential and renewing the adsorption capacity of the media.

16.5 MOE Design Criteria

Section 4 of the Design Guidelines for Sewage Works discusses the generation and measurement of odour in wastewater treatment and identifies various odour control and abatement measures, but does not provide specific criteria for the design of odour control systems.

16.6 Process Design Calculations

Process design calculations were performed by the manufacturer of the odour control unit based on the specifications prepared by Consulting Ltd. to determine appropriate sizing for the system,

media requirements, and anticipated odour removal efficiency. These calculations are considered proprietary and are not available for review.

16.7 Process Design Summary

Table 40 lists selected characteristics of the odour control system.

TABLE 40: ODOUR CONTROL SYSTEM – DESIGN SUMMARY

Parameter	Value
No. of Biofilter Modules	1
Vessel Diameter (m)	2.44
Media Volume (m^3)	11.3
Air Flow Capacity (m^3/min)	21.2
Empty Bed Residence Time (s)	30
Exhaust Fan Power (hp)	5
H2S Removal Efficiency, Inlet H2S = 20 ppm (%)	>99
H2S Removal Efficiency, Inlet H2S = 300 ppm (%)	90
Odour Removal Efficiency, Inlet Odour = 3,000 – 10,000 OU/m^3 (%)	90
Make Up Water Rate (L/s)	0.016

17.0 CONTINGENCY PLANNING

17.1 Spill Control and Countermeasures Plan

The ACME WWTP has a plan in place to minimize any impacts on human and environmental health in the event of accidental release of sludge, untreated wastewater, or chemicals to the environment. The plan will be updated to incorporate the new treatment facilities, but basic procedures will remain unchanged.

The following summarizes the procedure to be applied in the event of a spill at the ACME WWTP.

1. If the spill is ongoing in nature (i.e. a leak or continuous overflow) shut down any systems contributing to the spill to minimize the amount of liquid released. For example, if alum is leaking from a valve downstream of the chemical metering pump, disengage the pump to stop the flow of chemical through the valve.

2. Take actions to control the spread of the spilled material and to mitigate its effects. Some suggestions are given in the previous section, but it is recommended that for chemical spills, the appropriate Material Safety Data Sheet (MSDS) be consulted for instructions on spill control and/or neutralization.

3. Assess notification requirements. According to the MOE's Spills Action Centre, spills must be reported immediately to the ministry and to the municipality when they cause or are likely to cause any of the following:

    - impairment to the quality of the natural environment - air, water, or land;
    - injury or damage to property or animal life;
    - adverse health effects;
    - safety risk;
    - making property, plant, or animal life unfit for use;
    - loss of enjoyment of normal use of property; or
    - interference with the normal conduct of business.

4. Spill reports should be directed (via telephone) to the Spills Action Centre.

Spills Action Centre
5775 Yonge Street (5th floor)
North York ON M2M 4J1
Toll Free: **1-800-268-6060**
Tel: (416) 325-3000
Fax (416) 325-3011

The existing ACME WWTP C of A also requires notification of the MOE District Manager in the event of a reportable spill. Contact information for the MOE Anyplace Regional office is given below:

Ministry of the Environment
Anyplace Regional Office
987 Somestreet Lane
Anyplace ON X1Y 2Z3
Tel: (123) 555-0369
Fax: (123) 555-9630

5. After the spill is adequately contained and has been reported to the appropriate authorities, safely collect and dispose of the spilled material. Depending on the nature of the spill, the MOE may assist in or oversee clean-up efforts.

6. Assess the impact of the spill. If damages to the plant infrastructure or contamination of the natural environment resulted, develop and implement a repair/restoration/remediation plan.

7. Assess the cause of the spill and if possible develop and implement a preventative measures plan to minimize the risk of future similar occurrences. The preventative measures plan may include modification of plant operating or maintenance procedures.

17.2 Equipment Failure and Contingency Plan

The ACME WWTP has a plan in place to minimize the impact of equipment failure on plant operation and prevent the release of untreated wastewater to the environment. The plan will be updated to incorporate the new treatment facilities, but basic procedures will remain unchanged.

Redundancy has been provided for all major equipment including influent pumps (at the Boulevard Road PS), aeration blowers, RAS/WAS pumps, and chemical metering pumps. The process narrative describes indicators and alarms that will alert the operator of the failure, and in most cases the load will be automatically shifted to standby equipment.

Major unit process have also been designed with redundancy to ensure continuous treatment if one train is out of service for maintenance or repair.

APPENDIX A

ASSIMILATIVE CAPACITY STUDY REPORT

APPENDIX B

PUMP STATION DESIGN CALCULATIONS

TABLE 1: FLOW RATE ENTRY

Project Number: 53469
CITY OF ANYTOWN
ACME WWTP EXPANSION (Boulevard Road Pumping Station Expansion)
HEAD LOSS CALCULATIONS

Known Capacity	0	m^3	*0 if not known*
Time to Empty	1	hours	*1 if not known*
Known Flow Rate	0.133	m^3/second	
Pipe Area	0.130	m^2	
Flow Velocity:	1.03	m/s	
DESIGN FLOW RATE:	**0.133**	m^3/second	
(various units)	**133.000**	L/s	
	478.800	m^3/Hour	
	11491.200	m^3/Day	
	35.135	usg/second	
	2108.093	usgpm	
	126485.554	usg/Hour	
	3035653.286	usg/Day	

TABLE 2: PIPE FITTING INPUTS

Project Number: 53469
CITY OF ANYTOWN
ACME WWTP EXPANSION (Boulevard Road Pumping Station Expansion)
HEAD LOSS CALCULATIONS

Fluid Properties			
	Density	999	kg/m^3
	Velocity	1.0	m/s
	Pipe Diameter	0.4064	m
	Dynamic Viscosity	0.00112	$N*s/m^2$
	Reynold's #	371668	

C - Factors	C=	f =
	120	0.023
	130	0.020
	140	0.017

			C=120	C=130	C=140	C=120	C=130	C=140
#	Description	K_L	L_{eq} / fitting	L_{eq} / fitting	L_{eq} / fitting	L_{eq} total	L_{eq} total	L_{eq} total
7	Regular 90 elbow - Flanged	0.3	5.3	6.2	7.1	37.14	43.07	49.40
0	Regular 90 elbow - Threaded	1.5	26.5	30.8	35.3	0.00	0.00	0.00
0	Long Radius 90 - Flanged	0.2	3.5	4.1	4.7	0.00	0.00	0.00
0	Long Radius 90 - Threaded	0.7	12.4	14.4	16.5	0.00	0.00	0.00
8	Regular 11 Degree Bend	0.044	0.8	0.9	1.0	6.23	7.22	8.28
0	Regular 22.5 Degree Bend	0.154	2.7	3.2	3.6	0.00	0.00	0.00
0	Regular 30 Degree Bend	0.165	2.9	3.4	3.9	0.00	0.00	0.00
0	Long Radius 45 - Flanged	0.2	3.5	4.1	4.7	0.00	0.00	0.00
0	Regular 45 elbow - Threaded	0.4	7.1	8.2	9.4	0.00	0.00	0.00
0	180 return bend - Flanged	0.2	3.5	4.1	4.7	0.00	0.00	0.00
0	180 return bend - Threaded	1.5	26.5	30.8	35.3	0.00	0.00	0.00
1	Line Flow T - Flanged	0.2	3.5	4.1	4.7	3.54	4.10	4.70
0	Line Flow T - Threaded	0.9	15.9	18.5	21.2	0.00	0.00	0.00
0	Branch Flow T - Flanged	1	17.7	20.5	23.5	0.00	0.00	0.00
0	Branch Flow T - Threaded	2	35.4	41.0	47.0	0.00	0.00	0.00
0	Threaded union	0.8	14.2	16.4	18.8	0.00	0.00	0.00
0	Globe Valve, open	10	176.9	205.1	235.2	0.00	0.00	0.00
0	Angle, Open	2	35.4	41.0	47.0	0.00	0.00	0.00
2	Gate, Open	0.15	2.7	3.1	3.5	5.31	6.15	7.06
0	Gate 1/4 closed	0.26	4.6	5.3	6.1	0.00	0.00	0.00
0	Gate 1/2 closed	2.1	37.1	43.1	49.4	0.00	0.00	0.00
0	Gate 3/4 closed	17	300.7	348.7	399.9	0.00	0.00	0.00
1	Swing Check	3	53.1	61.5	70.6	53.06	61.53	70.57
0	Ball, Open	0.05	0.9	1.0	1.2	0.00	0.00	0.00
0	Ball, 1/3 closed	5.5	97.3	112.8	129.4	0.00	0.00	0.00
0	Ball, 2/3 closed	210	3714.4	4307.2	4940.2	0.00	0.00	0.00
					Total Length	105.28	122.08	140.02

TABLE 3: ENTRY AND EXIT LOSSES

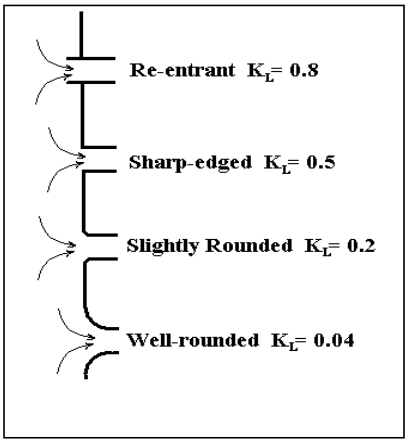
Project Number: 53469
CITY OF ANYTOWN
ACME WWTP EXPANSION (Boulevard Road Pumping Station Expansion)
HEAD LOSS CALCULATIONS

Fluid Properties		
Density	999	kg/m^3
Velocity	1.0	m/s
Pipe Diameter	0.4064	m
Dynamic Viscosity	0.00112	$N*s/m^2$
Reynold's #	371668	

C - Factors	C=	f =
	120	0.023
	130	0.020
	140	0.017

			C=120	C=130	C=140	C=120	C=130	C=140
#	Description	K_L	L_{eq} / fitting	L_{eq} / fitting	L_{eq} / fitting	L_{eq} total	L_{eq} total	L_{eq} total
0	Flow from tank - re-entrant	0.8	14.2	16.4	18.8	0.0	0.0	0.0
1	Flow from tank - sharp-edged	0.5	8.8	10.3	11.8	8.8	10.3	11.8
0	Flow from tank - Slightly round	2	35.4	41.0	47.0	0.0	0.0	0.0
0	Flow from tank - well-rounded	0.15	2.7	3.1	3.5	0.0	0.0	0.0
1	Flow into tank - any	1	17.7	20.5	23.5	17.7	20.5	23.5
			Total Length			26.5	30.8	35.3

Flow From Tank



Flow Into Tank

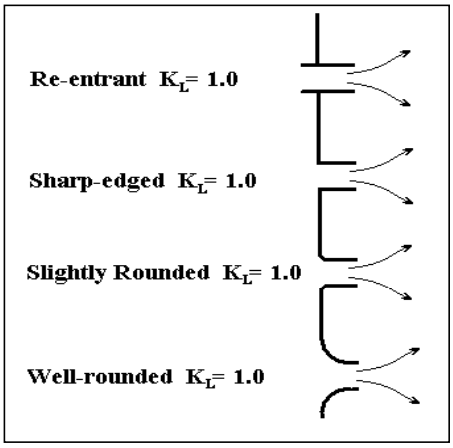


TABLE 4: HEAD LOSS CALCULATION

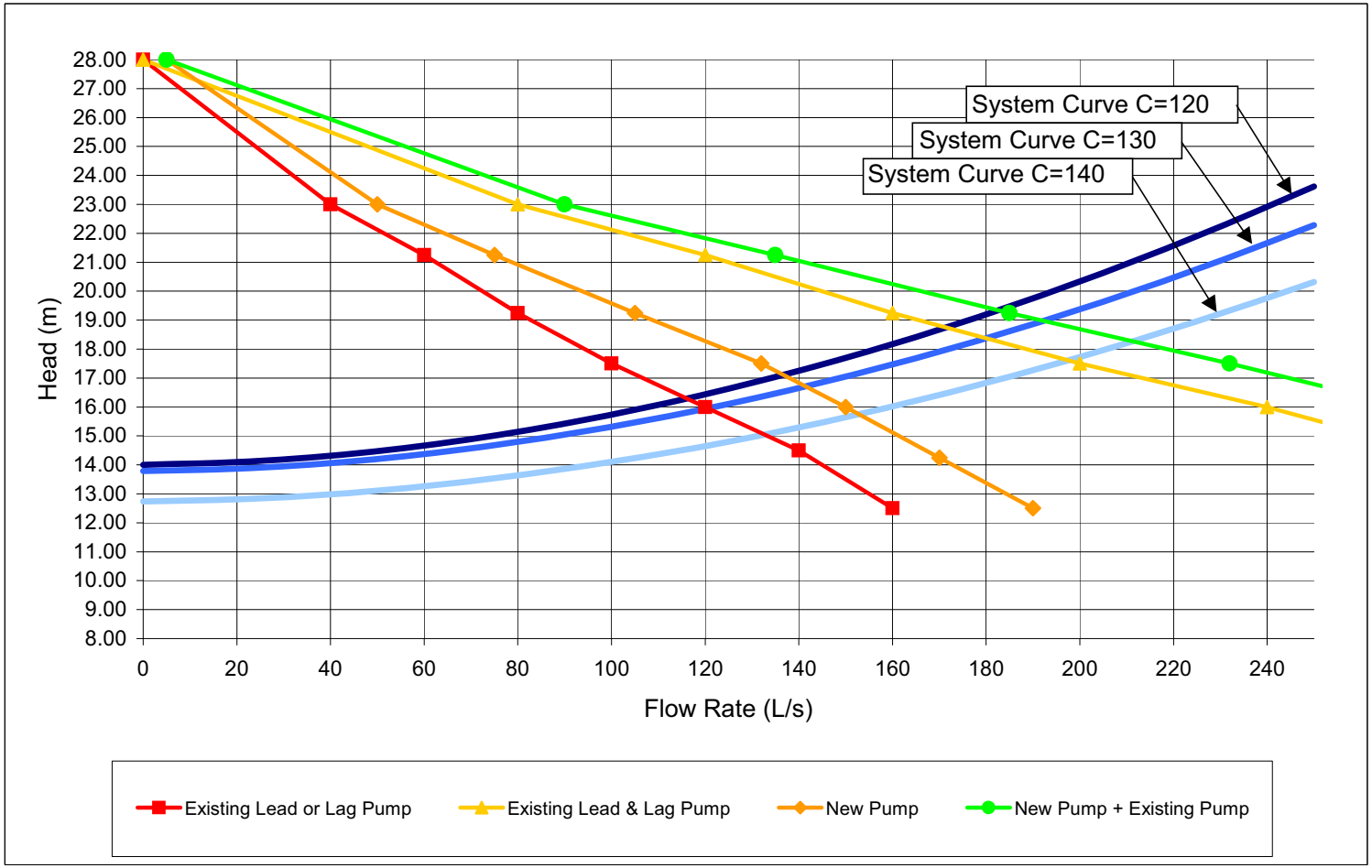
Project Number: 53469
CITY OF ANYTOWN
ACME WWTP EXPANSION (Boulevard Road Pumping Station Expansion)
HEAD LOSS CALCULATIONS

		C=120	C=130	C=140	
Previous Data	Velocity	1.0	1.0	1.0	m/s
	Pipe Dia	0.4064	0.4064	0.4064	m
	f:	0.023	0.020	0.017	
	g:	9.8	9.8	9.8	m/s^2
	Fittings L_{eq} :	105.28	122.08	140.02	m
	Entrances/Exits	26.531475	30.766018	35.286856	m
	Length of Pipe:	842	842	842	m
	Total:	973.81	994.85	1017.31	m
Head loss due to Fittings & Friction:		2.95	2.60	2.32	m

	Low	Operating	Overflow		
Start Elevation:	171.92	172.13	173.18	m	
Finish (Max) Elevation:	185.92	185.92	185.92	m	
delta z:	14.00	13.79	12.74	m	uphill
Total Head Required	16.95	16.39	15.06	m	

SYSTEM CURVES FOR ACME WWTP EXPANSION (Boulevard Road Pumping Station Expansion)

Project Number: 53469
CITY OF ANYTOWN
ACME WWTP EXPANSION (Boulevard Road Pumping Station Expansion)
HEAD LOSS CALCULATIONS



APPENDIX C

SECONDARY TREATMENT DESIGN CALCULATIONS

ACME WWTP Expansion
Project No.: 053469-20

PROCESS DESIGN CALCULATIONS – BIOLOGICAL TREATMENT

Date: December 20, 2009

Designed by: Junior Engineer

Checked by: Jo Consultant

Aeration Demand

Step 1: Determine Design Flows and Influent Concentrations

The design flows and influent water quality parameters for the proposed expansion are summarized in Table 1.

TABLE 1: Design Flows and Influent Water Quality

Parameter		Unit	Value
Flow	MinDF	m^3/d	1,118
	AADF	m^3/d	1,669
	MMADF	m^3/d	2,036
	MDF	m^3/d	3,405
	PHF	m^3/d	6,676
$CBOD_5$	Average	mg/L	150
	Peak	mg/L	270
BOD_5	Average	mg/L	180
	Peak	mg/L	324
TKN	Average	mg/L	30
	Peak	mg/L	54
TP	Average	mg/L	9
	Peak	mg/L	16
NH4+-N	Average	mg/L	20
	Peak	mg/L	36

Step 2: Calculate $CBOD_5$ Loading

$CBOD_5$ is important in estimating the oxygen requirements of the system. The loading of $CBOD_5$ under each design flow condition was determined using the following simple equation:

Flow (m^3/d) * $CBOD_5$ (mg/L) / 1000 = $CBOD_5$ Loading (kg/d)

Table 2 summarizes estimated $CBOD_5$ loadings under various flow conditions.

TABLE 2: $CBOD_5$ Loading

Flow Condition	Average (kg/d)	Peak (kg/d)
AADF	250	451
MMADF	305	550
MDF	511	919
MinDF	168	302
PHF	1001	1803

Step 3: Determine the Amount of Nitrogen to be Nitrified

It was necessary to calculate the loading of nitrogen (N) to be nitrified in the aeration process. Available N in the influent is TKN minus non-biodegradable organic nitrogen. In this case, the amount of non-biodegradable organic nitrogen was unknown, and because it typically small compared to the amount of biodegradable N, it is assumed to be negligible. Therefore the amount of available N is approximately equal to the concentration of TKN.

TABLE 3: Available Nitrogen Concentration

Average (mg/L)	Peak (mg/L)
30	54

Not all of the available N will be nitrified during aeration; some is used for cell synthesis. The amount of N used for cell synthesis is:

$$N_{cell\ synthesis}\ (mg/L) = (N_{biomass} * CBOD_5 * Y)/(1 + (b * SRT)),$$

where $N_{biomass}$ is the typical nitrogen content of the biomass (assumed to be 0.1 kg N/kg VSS), $CBOD_5$ is the influent $CBOD_5$ concentration, Y is the biomass yield coefficient (0.5 kg VSS/kg $CBOD_5$ removed), b is the decay coefficient (0.06 d^{-1}), and SRT is the solids retention time of the aeration basin (18 d). The assumed values for these variables are listed below.

TABLE 4: Nitrogen Consumption for Cell Synthesis - Variables

Parameter	Average	Peak	Units
Influent $CBOD_5$	150	270	mg/L
Y	0.5	0.5	kg VSS/kg BOD_5 removed
b	0.06	0.06	d^{-1}
Nitrogen content of biomass	0.1	0.1	kg N/kg VSS
SRT	18	18	d

Nitrogen used for cell synthesis is subtracted from the amount of available nitrogen. The result is the amount of N to be nitrified during aeration, from which the applicable nitrogen loading may be determined. Table 5 presents the estimated average and peak concentrations of nitrogen consumed for cell synthesis and the amount of available nitrogen remaining.

TABLE 5: Nitrogen Consumption for Cell Synthesis and Remaining Available Nitrogen

Nitrogen Consumption	Average (mg/L)	Peak (mg/L)
Nitrogen for cell synthesis	3.61	6.49
Nitrogen for nitrification	26.4	47.5

The mass loading of available nitrogen minus the amount of nitrogen required for cell synthesis was calculated for various flow conditions. The results are summarized in Table 6.

TABLE 6: Mass Loading of Nitrogen to be Nitrified

Flow Condition	Average (kg/d)	Peak (kg/d)
AADF	44	79
MMADF	54	97
MDF	90	162
MinDF	30	53
PHF	176	317

Step 4: Calculate Carbonaceous POR

The carbonaceous process oxygen requirement (POR) is a result of cell synthesis and endogenous respiration. According to the EPA Fine Pore Aeration System Design Manual, in the absence of experimentally determined design values the carbonaceous POR may be estimated through the use of a simple ratio.

For standard aeration processes, this ratio is 1.1 lb O_2/lb $CBOD_5$. In the case of extended aeration, the ratio increases to 1.8. The carbonaceous POR for the new plant was determined by applying the second ratio to the $CBOD_5$ loading calculated in step 2. Table 7 summarizes carbonaceous process oxygen requirements for the new aeration system.

TABLE 7: Carbonaceous Process Oxygen Requirements

Flow Condition	Average (kg O_2/d)	Peak (kg O_2/d)
AADF	451	811
MMADF	550	989
MDF	919	1,655
MinDF	302	543
PHF	1803	3,245

Step 5: Calculate Nitrogenous POR

Nitrogenous POR results from the biological nitrification of ammonia nitrogen in the influent to nitrate nitrogen. The nitrogenous POR is typically estimated stoichiometrically. Theoretically, 4.57 lb O2 are required per lb of nitrate nitrogen produced (equal to the amount of nitrogen to be nitrified).

This ratio was applied to the nitrogen loadings calculated in step 3 to determine the expected nitrogenous POR for the new aeration plant. Table 8 summarizes carbonaceous process oxygen requirements for the new aeration system.

TABLE 8: Nitrogenous Process Oxygen Requirements

Flow Condition	Average (kg O_2/d)	Peak (kg O_2/d)
AADF	201	362
MMADF	246	442
MDF	411	739
MinDF	135	243
PHF	805	1,449

Step 6: Calculate Total POR

The total aeration POR was calculated by adding together the carbonaceous POR and nitrogenous POR for each flow condition. Table 9 presents the total estimated POR.

TABLE 9: Total Process Oxygen Requirements

Flow Condition	Average (kg O_2/d)	Peak (kg O_2/d)
AADF	652	1,174
MMADF	795	1,432
MDF	1,330	2,394
MinDF	437	786
PHF	2,608	4,694

Step 7: Calculate SOTR

The POR values obtained in step 6 were converted to standard oxygen transfer rates (SOTR) to account for the effects of process operating conditions. A number of variables were necessary to make the conversion. They are listed below.

TABLE 10A: Standard Oxygen Transfer Rate – Variables

Variable	Definition
$C^*_{\infty 20}$	steady-state DO saturation concentration for a given diffuser at standard conditions
β	process water $C^*_{\infty 20}$/clean water $C^*_{\infty 20}$
C	process water DO concentration
τ	temperature correction for C^*_{∞}
Ω	pressure correction for C^*_{∞}
θ	1.024
T	process water temperature
α	process water K_La of a new diffuser/clean water K_La of a new diffuser
F	process water K_La of a diffuser after time t/ process water K_La of a new diffuser

These variables are combined in the following equation to determine SOTR.

$$SOTR = POR * C^*_{\infty 20} / [\alpha F * \theta^{T-20} * (\Omega * \tau * \beta * C^*_{\infty 20} - C)]$$

$C^*_{\infty 20}$ is dependent on diffuser type and depth below water, and is best determined through clean-water testing. Testing was not possible prior to the design of the new aeration system, so information from the EPA's Fine Pore Aeration System Design Manual was used to determine an appropriate estimate. Assuming diffuser submergence is approximately 4.6 m, a value of 10.5 mg/L was selected. The value of C is also best determined through actual testing, but in the absence of test results the EPA Design Manual suggests a value of 2.0 mg/L for average month nitrifying conditions.

β, α, and F are characteristic of the process water and specific diffuser used. They may be determined experimentally, but may also be estimated based on the performance of similar systems. A β value between 0.95 and 0.98 is typical for wastewater. A value of 0.95, from the Siemens depth calculation table, was used for these calculations. The table also gave an α value of 0.55 for the fine bubble diffusion system to be installed at the new plant. This falls within the typical range of α values for diffused aeration equipment. It was assumed that F was approximately equal to 0.9.

Temperature and pressure corrections are applied to $C^*_{\infty 20}$ to approximate actual conditions at the site. Temperature was assumed to be 20°C so τ, the temperature correction factor, was equal to 1. If T is different than 20°C, $\tau = C^*_{\infty T}/C^*_{\infty 20}$.

The approximate elevation of the aeration basins is 180 m. At this elevation, average atmospheric pressure may be estimated at 14.3 psi. The pressure correction factor, Ω, is this pressure divided by atmospheric pressure at an elevation of 0 m (14.7 psi). The value of Ω is 0.97.

Table 10B lists the assumed value of all variables.

TABLE 10B: Standard Oxygen Transfer Rate – Variables

Variable	Value	Units
$C^*_{\infty 20}$	10.5	mg/L
β	0.95	unitless
C	2.0	mg/L
τ	1	unitless
Ω	0.97	unitless
θ	1.024	unitless
T	20	°C
α	0.55	unitless
F	0.9	unitless

The SOTR for the new secondary treatment system under various flow conditions was calculated. Table 11 summarizes the average and peak SOTR for various flow conditions.

TABLE 11: Standard Oxygen Transfer Rate

Flow Condition	Average (kg O2/d)	Peak (kg O2/d)
AADF	1,820	3,277
MMADF	2,221	3,997
MDF	3,714	6,685
MinDF	1,219	2,195
PHF	7,282	13,107

Step 8: Calculate the Required Air Flow Rate

The required air flow rate may be calculated using the following equation:

Air Flow Rate = SOTR / (SOTE * ρ_{air} * fraction of oxygen in air)

To determine the required air flow rate to the aeration basin, the density of air and the relative mass concentration of oxygen in air must be known. The density of air was assigned a value of 1.201 kg/m^3, typical of air at 20°C and pressures close to standard atmospheric pressure. The mass percent of oxygen in air is 23.2%.

The standard oxygen transfer efficiency (SOTE) is also important. It indicates the percentage of oxygen pumped into the basin that will be used effectively. A large portion of the oxygen pumped into the basins will simply pass through the water and escape to the surrounding air, so while the SOTR indicates the amount of oxygen required for aeration, the actual amount of oxygen pumped into the basins must be much greater. Typical SOTE for fine bubble diffusers ranges as high as 37%. An SOTE of about 25% was used based on information presented in the Siemens depth calculation table.

Table 12 summarizes the required air flow rates for various wastewater flow conditions.

TABLE 12: Air Flow Requirements

Flow Condition	Average		Peak	
	m^3/d	**m^3/min**	**m^3/d**	**m^3/min**
AADF	26,134	18.1	47,042	32.7
MMADF	31,881	22.1	57,386	39.9
MDF	53,318	37.0	95,972	66.6
MinDF	17,506	12.2	31,511	21.9
PHF	104,537	72.6	188,167	130.7

Step 9: Confirm Mixing Requirements

Section 12.2.4.6 of the Design Guidelines for Sewage Works recommends a minimum air flow rate of 0.61 L/(m^2s) in order to maintain uniform MLSS levels with a fine bubble aeration system.

The horizontal combined cross-sectional area of the aeration basins is approximately 386 m^2. Therefore, the minimum required airflow rate for adequate mixing is 14.1 m^3/min. The new aeration system will satisfy this mixing requirement.

Organic Loading Rate

$CBOD_5$ is the 5-day biochemical oxygen demand measured with the use of an inhibitor to suppress nitrogenous oxygen demand, while BOD_5 is the 5-day biochemical oxygen demand measured without the use of an inhibitor. In accordance with MOE Design Guidelines, BOD_5 (instead of $CBOD_5$) was used to determine secondary treatment design parameters because $CBOD_5$ has often been shown to underestimate the organic strength of wastewater.

The organic loading rate to a biological treatment system is defined as the BOD_5 mass loading rate per unit volume of the system. The design average and peak influent BOD_5 concentrations are 180 mg/L and 324 mg/L respectively. At the design average day flow (new secondary treatment system only), the estimated average and peak BOD_5 loadings are:

Average
180 mg/L * 1,669 m^3/d / 1000 = 300.4 kg/d

Peak
324 mg/L * 1,669 m^3/d / 1000 = 540.8 kg/d

Each aeration basin measures approximately 4.6 m SWD x 6.9 m x 28.0 m. The combined volume of the aeration basins is 1,777.4 m^3. The average and peak organic loading rates are calculated below.

Average
300.4 kg/d / 1,777.4 m^3 = **0.17 kg BOD_5/(m^3d)**

Peak
540.8 kg/d / 1,777.4 m^3 = **0.30 kg BOD_5/(m^3d)**

The average and peak organic loading rates to the new secondary treatment system are within the range recommended in the Design Guidelines for Sewage Works.

F/M Ratio

The F/M (food-to-microorganism) ratio describes the relationship between the mass of substrate and the mass of biomass in a biological treatment system.

$F/M = QS_o/VX$

where Q is the influent wastewater flowrate, S_o is the influent BOD_5 concentration, V is the volume of the reactor (aeration basin), and X is the biomass (MLVSS) concentration of the reactor. It is assumed that the MLVSS:MLSS ratio in the aeration basins will be near 0.8, typical for conventional activated sludge systems. The average F/M ratio for the new secondary treatment system is:

F/M = (1,669 m^3/d * 180 mg/L) / (1,777.4 m^3 * 0.8(3,000 mg/L))

F/M = 0.07

An F/M ratio of 0.07 is within the range recommended for extended aeration systems in the Design Guidelines for Sewage Works.

Solids Retention Time

The solids retention time of the biological treatment system may be calculated using the following equation:

$SRT = VX/((Q-Q_w)X_e + Q_wX_r)$

where V is the volume of the reactor, X is the MLVSS concentration of the reactor, Q is the influent wastewater flow rate, Q_w is the WAS flow rate (33.9 m^3/d), X_e concentration of biomass in the clarifier effluent, and X_r is the biomass concentration of RAS (7,000 mg/L). If it is assumed that the concentration of biomass in the clarifier effluent is low relative to the RAS biomass concentration:

$SRT \approx VX/Q_wX_r$

$= ((1{,}777.4\ m^3) * 0.8(3{,}000\ mg/L)) / (33.9\ m^3/d * 7{,}000\ mg/L)$

SRT = 18.0 d

An SRT of 18 d is greater than the minimum SRT (15 d) recommended for extended aeration systems in the Design Guidelines for Sewage Works.

Alum Dosing for Phosphorus Removal

Method 1 – Based on Historical Data

From historical data dating back three years, the average daily volume of commercial alum used was 180 L. The average wastewater flow through the plant was about 1,033 m^3/d over the same period. The alum dosage was:

180 L / 1,033 m^3/d = 0.174 L/ (m^3/d)

Assuming that the composition and characteristics of the wastewater, and therefore the required alum dosage (0.174 L/ (m^3/d)), are unchanged with expected increases in flow, the alum use with a design average daily flow of 2,874 m^3 is:

0.174 L/ m^3/d * 2,874 m^3/d = 500.79 L alum

A peaking factor of 2 for alum dosing has been observed at the plant. Therefore the anticipated design peak alum dosage is **1,001.58 L alum/d (41.73 L/h).**

Method 2 – Based on Rule of Thumb Ratio

The design average and peak total phosphorus (TP) concentrations are 9 mg/L and 16 mg/L respectively. Over the past three years, the maximum influent TP concentration was 7.5 mg/L, so a design TP concentration of 9 mg/L is adequate. To achieve an effluent TP concentration of 0.1 mg/L, at least 8.9 mg/L must be removed.

The design average daily TP loading (assuming annual average daily flow) is:

(9 mg/L * 2,874 m^3/d)/1000 = 25.86 kg/d

The desired average daily TP removal rate is:

(8.9 mg/L * 2,874 m^3/d)/1000 = 25.58 kg/d

A typical rule of thumb for alum dosing for phosphorus removal is 28 L alum (commercial-grade) / kg P. This value represents a safety factor of approximately 2 applied to the stoichimetrically required alum dosage. With a TP removal requirement of 25.58 kg/d, the required alum dosage is:

28 L/kg * 25.58 kg/d = **716.24 L alum/d (29.84 L/h)**

Based on current chemical use patterns, future use of commercial-grade alum for phosphorus removal during secondary treatment (existing and new) is estimated at 42 L/h. Calculations based on the rule of thumb suggest that a much lower dosage would suffice. It is recommended that jar-testing be performed after construction of the WWTP expansion to optimize chemical usage at plant.

Note that alum injection points in the new secondary treatment system are to be located in both the aeration basins and secondary clarifiers.

Waste Activated Sludge Production

Biological Solids Production

MOE Design Guidelines for Sewage Works reports a typical biological solids production rate (observed yield) of 0.85 kg TSS/kg BOD_5 removed for activated sludge plants without primary clarifiers.

Influent BOD_5 (design average) = 180 mg/L

Effluent BOD_5 (measured average) = 1.5 mg/L

The estimated rate of biological solids production at the ACME WWTP (including both new and existing secondary treatment systems) is:

0.85 (180 mg/L – 1.5 mg/L) * 2,874 m^3/d / 1000 = **436.0 kg/d**

Chemical Solids Production

In addition to biological activity, chemical addition also contributes to secondary sludge production. At the ACME WWTP, alum (hydrated aluminum sulfate) is added to the secondary treatment system for phosphorus removal.

Influent TP (design average) = 9 mg/L

Effluent TP (measured average) = 0.35 mg/L

To determine the rate of phosphorus uptake by microorganisms, assume a BOD_5 to P ratio of 100:1, i.e. for removal every 100 parts BOD_5, 1 part TP is consumed.

The amount of phosphorus consumed biologically is:

(180 mg/L – 1.5 mg/L) / 100 = **1.79 mg/L**

The amount of phosphorus removed chemically is:

9 mg/L – 1.79 mg/L – 0.35 mg/L = **6.86 mg/L**

Based on current chemical use patterns, the average rate of use of commercial grade (50%) alum will be about 500 L/d at the design AADF (see "Alum Dosing for Phosphorus Removal"). The density of 50% alum solution is approximately 1,600 kg/m^3.

500 L/d * 1.6 kg/L = 800 kg/d

800 kg/d * 50% = 400 kg/d

The estimated average alum dosage is:

400 kg/d / 2,874 m3/d * 1000 = **139.2 mg/L**

The reaction of alum with phosphorus produces $AlPO_4$ precipitate. The mass of $AlPO_4$ precipitate produced is:

P removed * (MW $AlPO_4$ / MW P) = 6.86 mg/L * (122 g/mol / 31 g/mol) = **27.0 mg/L**

Unused alum will react with natural alkalinity to produce $Al(OH)_3$ precipitate. The mass of alum consumed by reaction with phosphorus is:

P Removed * (MW Alum / (2 * MW P)) = 6.86 mg/L * (666 g/mol / (2 * 31 g/mol)) = **73.7 mg/L**

The mass of unused alum is:

Alum Dosed – Alum Consumed = 139.2 mg/L – 73.7 mg/L = **65.5 mg/L**

The mass of $Al(OH)_3$ precipitate produced is:

Unused Alum * ((2 * MW $Al(OH)_3$) / MW Alum) = 65.5 mg/L * ((2 * 78 g/mol) / 666 g/mol) = **15.3 mg/L**

The total mass of chemical sludge produced is:

27.0 mg/L + 15.3 mg/L = **42.3 mg/L**

Total Solids

The total mass of solids yielded during secondary treatment is:

Biological Solids + Chemical Solids = (151.7 + 42.3 mg/L) * 2874 m3/d / 1000 = **557.6 kg/d**

Some solids escape in secondary effluent, although this portion is small. Assuming an average secondary effluent TSS concentration of 5 mg/L, the amount of solids carried from the system in secondary effluent is:

5 mg/L * 2,874 m3/d / 1000 = **14.4 kg/d**

Therefore the estimated rate of solids wasting (as waste activated sludge) is:

557.6 kg/d – 14.4 kg/d = **543.2 kg/d**

ACME WWTP Expansion
Project No.: 053469-20

PROCESS DESIGN CALCULATIONS – SECONDARY SEDIMENTATION

Date: January 5, 2009

Designed by: Junior Engineer

Checked by: Jo Consultant

Solids Loading Rate

The volume of mixed liquor flow to the secondary clarifiers is equal to the influent wastewater flow plus the RAS rate. The new sludge pumping system was designed to accommodate RAS rates ranging from 50 to 200 % of the design AADF. The flow of mixed liquor to the secondary clarifiers under AADF and PDF conditions and for various RAS rates is listed in the table below.

RAS Rate (% AADF)	Average Mixed Liquor Flow (m^3/d)	Peak Mixed Liquor Flow (m^3/d)
50	2,504	5,108
100	3,338	6,810
150	4,173	8,513
200	5,007	10,215

Each clarifier measures approximately 4.9 m x 20.0 m. The combined surface area of the clarifiers is 196 m^2. Assuming a MLSS concentration of 3,000 mg/L, the solids loading rate for various RAS rates/mixed liquor flows was calculated (see below).

RAS Rate (% AADF)	Average Solids Loading Rate (kg/m^2d)	Peak Solids Loading Rate (kg/m^2d)
50	38.3	78.2
100	51.1	104.2
150	63.9	130.3
200	76.6	156.4

Under all conditions, the solids loading rate to the secondary clarifiers is less than the maximum solids loading rate recommended in the Design Guidelines for Sewage Works (170 $kg/(m^2d)$).

Surface Overflow Rate

The secondary clarifier surface overflow rate (effluent flow rate / clarifier surface area) for various plant flow conditions is shown in the table below.

Condition	SOR ($m^3/(m^2d)$)
Annual Average Daily Flow	8.5
Maximum Month Average Daily Flow	10.4
Maximum Daily Flow	17.4
Minimum Daily Flow	5.7
Peak Hourly Flow	34.1

Under peak hour flow conditions, the clarifier surface overflow rate less than the PHF surface overflow rate recommended in the Design Guidelines for Sewage Works (37 $m^3/(m^2d)$).

Effluent Weir Loading Rate

The total length of the effluent launders in the new secondary clarifiers is 54 m. The secondary effluent weir loading rate (effluent flow rate / weir length) for various plant flow conditions is shown in the table below.

Condition	Weir Loading Rate (m^3/(md))
Annual Average Daily Flow	30.9
Maximum Month Average Daily Flow	37.7
Maximum Daily Flow	63.1
Minimum Daily Flow	20.7
Peak Hourly Flow	123.6

Under peak hour flow conditions, the effluent weir loading rate is less than the maximum PHF effluent weir loading rate recommended in the Design Guidelines for Sewage Works (250 m^3/(md)).

APPENDIX D

PROCESS MODELLING INPUT AND OUTPUT

(CD Enclosed)

APPENDIX E

TERTIARY TREATMENT DESIGN CALCULATIONS

ACME WWTP Expansion
Project No.: 053469-20

PROCESS DESIGN CALCULATIONS – TERTIARY TREATMENT

Date: January 16, 2009

Designed by: Junior Engineer

Checked by: Jo Consultant

Hydraulic Loading

After evaluation of various filter models, the NP-50 module was selected for installation at the ACME WWTP for its small footprint, economic value, and low maintenance requirements. Each concrete filter cell will contain two modules with a combined filtration area of 9.3 m2.

For various system sizes (ranging from 1 to 6 cells per filtration stage), a simple analysis was performed to determine the HLR (in L/(m2s)) to the system under different flow conditions. A backwash return rate of 0.88 L/s per module was assumed.

Sample Calculation

Measured plant flow = 2,874 m3/d (AADF)

Filtration area per stage = 18.6 m2 (2 cells in operation per stage)

Backwash = 2 cells/stage * 2 stages * 2 modules/cell * 0.88 L/s = 7.04 L/s = 608 m3/d

Total filter influent flow = 2,874 m3/d + 608 m3/d = 3,482 m3/d

HLR = 3,482 m3/d / 18.6 m2 = 187 m3/(m2d) = **2.17 L/(m2s)**

The table below shows the HLR (in L/(m2s)) for various conditions.

Filter Cells per Stage	**Filtration Area per Stage (m^2)**	**Measured Plant Flow (m^3/d)**						
		Current AADF	Current Capacity	Design MinDF	Design AADF	Design MMADF	Design MDF	Design PHF
		1,000	1,205	1,926	2,874	3,506	5,863	11,496
1	9.3	1.63	1.88	2.78	3.96	4.75	7.68	14.70
2	18.6	1.00	1.13	1.58	2.17	2.56	4.03	7.54
3	27.9	0.80	0.88	1.18	1.57	1.84	2.82	5.15
4	37.2	0.69	0.76	0.98	1.28	1.47	2.21	3.96
5	46.5	0.63	0.68	0.86	1.10	1.25	1.84	3.24
6	55.8	0.59	0.63	0.78	0.98	1.11	1.60	2.77

In order to achieve a HLR less than 3.3 L/(m2s) at the design PHF, 6 filter cells per stage are required (5 in operation and 1 out of service, as per the Design Guidelines for Sewage Works). With a total filtration area of 55.8 m2 per stage, the system would be grossly oversized for treatment of the remaining design flows. For example, at the design average day flow, only one third of the available filtration area (2 cells per stage) would be in use.

After careful consideration, discussion with the NoPhos manufacturer, and consultation with the MOE technical staff, it was decided that during peak hour flow conditions, the system would be loaded to a rate near its hydraulic capacity (with one train out of service) as opposed to the maximum loading rate recommended by the MOE. This allows a reduction in system size to only 4 cells per stage. Because occurrences of the peak hour flow are expected to be relatively infrequent and should not exceed a few hours in duration, it is not expected that sub-optimal filter performance during this time will have an impact on the plant's ability to achieve its monthly average effluent objectives for TP and TSS.

Solids Loading

Historic plant data showed a maximum secondary effluent TSS concentration of 15.1 mg/L. The filtration system was designed assuming a peak TSS concentration of 30 mg/L, approximately twice the observed maximum.

At the design average day flow (including backwash flow), it is likely that only two filter cells will be in operation. The peak solids loading rate to the tertiary treatment system under these conditions is calculated below.

Backwash = 2 cells/stage * 2 stages * 2 modules/cell * 0.88 L/s = 7.04 L/s

Total filter influent flow = 2,874 m^3/d * 1000/24/60/60 + 7.04 L/s = 40.3 L/s

30 mg/L * 40.3 L/s = 1209 mg/s

1209 mg/s / 18.6 m2 = 65.0 mg/(m^2s)

The maximum anticipated solids loading rate under average day flow conditions is less than the peak solids loading rate recommended in the Design Guidelines for Sewage Works.

Backwash Flow as a Percentage of AADF

The NoPhos manufacturer reports typical backwash flows ranging from 0.44 to 0.88 L/s per filter module in operation, independent of the flow to the filter. NoPhos backwashing is continuous and automatic. The table below shows the backwash flow under various operating conditions assuming a backwash rate of 0.88 L/s.

Condition	Plant Flow (m^3/d)	Minimum No. of Operational Filter Cells per Stage	Backwash Flow (L/s)	% of AADF	% of Plant Flow
Current AADF	1,000	1	3.5	10.6%	30.5%
Current Capacity	1,205	1	3.5	10.6%	25.3%
Design MinDF	1,926	1	3.5	10.6%	15.8%
Design AADF	2,874	2	7.1	21.2%	21.2%
Design MMADF	3,506	2	7.1	21.2%	17.4%
Design MDF	5,863	3	10.6	31.8%	15.6%
Design PHF	11,496	4	14.1	42.4%	10.6%

Alum Dosing for Phosphorus Removal in the Tertiary Treatment System

Historic plant data showed a maximum secondary effluent TP concentration of 0.36 mg/L. The filtration system was designed assuming a maximum total phosphorus concentration of 0.7 mg/L, approximately twice the observed maximum.

The design maximum daily TP loading (assuming annual average daily flow) is:

(0.7 mg/L * 2,874 m^3/d)/1000 = 2.01 kg/d

A design objective of 0.1 mg/L has been identified for effluent TP. If the influent TP concentration is 0.7 mg/L, 0.6 mg TP/L must be removed within the tertiary treatment system. The maximum required TP removal rate during average daily flow conditions is:

(0.6 mg/L * 2,874 m^3/d)/1000 = 1.72 kg/d

A typical rule of thumb for alum dosing for phosphorus removal is 28 L alum (commercial-grade) / kg P. This value represents a safety factor of approximately 2 applied to the stoichimetrically required alum dosage. With a TP removal requirement of 1.72 kg/d, the required alum dosage is:

28 L/kg * 1.72 kg/d = 48.16 L alum/d (2.01 L/h)

APPENDIX F

SLUDGE HANDLING DESIGN CALCULATIONS

ACME WWTP Expansion
Project No.: 053469-20

PROCESS DESIGN CALCULATIONS – SLUDGE HANDLING

Date: February 11, 2009

Designed by: Junior Engineer

Checked by: Jo Consultant

Lamella Sludge Flow

To estimate the peak flow of sludge from the lamella clarifier, a sustained peak secondary effluent TSS concentration of 20 mg/L and an alum dosage of 5 mg/L to the tertiary influent was assumed.

Under PHF conditions (11,496 m3/d, or 479,000 L/h) the total solids loading to the tertiary treatment system is:

(20 mg/L + 5 mg/L) * 479,000 L/h = 12.0 kg/h

If the tertiary filters capture 100% of the influent solids, then the peak solids loading rate to the lamella clarifier is 12.0 kg/h. Polymer addition to the filter reject is assumed to be negligible.

Assuming 100% solids capture is the lamella clarifier and a solids concentration of 1% in the lamella underflow, the peak lamella sludge flow is:

12,000,000 mg/h / 10,000 mg/L = **1,200 L/h (0.33 L/s)**

Polymer Dosing

According to the EPA's Gravity Thickening Fact Sheet, polymer dosages for gravity thickening vary between 2.5 and 6.0 g active polymer per kg of dry solids, depending on the characteristics of the sludge to be thickened. A dosage of 6 g/kg was used to estimate peak polymer requirements at the ACME WWTP.

Polymer activity refers to the percent of the molecular weight of neat polymer that is available to react with and flocculate solids particles. According to WEF's Manual of Practice No. 8 (Design of Municipal Wastewater Treatment Plants), liquid emulsion polymers typically maintain an active solids level of 30-50%. An activity level of 40% was assumed.

Lamella Sludge (Continuous)

From previous calculations, the peak dry solids flow rate from the lamella clarifier is 12.0 kg/h. The required active polymer dosage is therefore:

6 g/kg * 12.0 kg/h = 72 g/h

This equates to a neat polymer mass flow rate of:

72 g/h / 0.4 = 180 g/h

If the specific gravity (SG) of liquid emulsion polymer is 1 and neat polymer is diluted to 0.25%, the required flow rates of neat polymer and dilution water are:

180 g/h * 1 L/1,000 g = **0.18 L/h**

and

0.18 L/h / 0.0025 = **72 L/h**, respectively.

WAS (Intermittent)

Sludge wasting from the existing and new secondary treatment systems will not occur simultaneously. The maximum WAS flow rate from either system is 13 L/s.

Assuming a WAS solids content of 0.7%, the peak dry solids rate to the thickeners is:

13 L/s * 1 kg/L * 0.007 = 0.091 kg/s

The required active polymer dosage is therefore:

6 g/kg * 0.091 kg/s = 0.546 g/s

This equates to a neat polymer mass flow rate of:

0.546 g/s / 0.4 = 1.37 g/s

If the SG of liquid emulsion polymer is 1 and neat polymer is diluted to 0.25%, the required flow rates of neat polymer and dilution water are:

1.37 g/s * 1 L/1,000 g = **0.00137 L/s**

and

0.00137 L/s / 0.0025 = **0.546 L/s**, respectively.

Gravity Thickener Sizing

Surface Area

Solids loading requirements are the primary determinant of gravity thickener sizing (surface area). The Design Guidelines for Sewage Works recommend a solids loading rate between 12 and 36 kg/(m^2d).

From Appendix C (Secondary Treatment Design Calculations), the total solids mass in WAS is approximately 540 kg/d. Solids from the lamella clarifier will also be directed to the gravity settlers, at a maximum rate of 12.0 kg/h (288 kg/d). Therefore anticipated peak solids loading to the gravity settlers is 828 kg/d.

Assuming a peak solids loading rate of 36 kg/(m^2d), the minimum required thickener surface area is:

828 kg/d / 36 kg/(m^2d) = 23.0 m^2

If the required surface area is split between two units, the diameter of each must be at least 3.8 m. The units were designed with a diameter of 4.5 m, for a total surface area of almost 32 m^2.

Volume

The gravity thickeners were designed to provide approximately 1day of sludge storage (assuming peak sludge flow rates). If the WAS dry solids mass flow rate is 540 kg TSS/d and the solids content of WAS is assumed to be 0.7%, the volumetric flow rate of WAS to the gravity thickeners is:

540 kg TSS/d / 0.007 / 1000 = 77.1 m^3/d

From previous calculations, the peak flow rate of lamella sludge is 28.8 m^3/d. The total flow rate of sludge to the gravity thickeners is 105.9 m^3/d. A storage capacity of 1 day is therefore equal to 105.9 m^3.

If the capacity is split between two units, the required volume of each is approximately 53.0 m^3.

Sludge Holding Tank Sizing

The footprint of the aerated sludge holding tank is constrained by the dimensions of the sludge handling building. The tank is approximately 13.75 m long by 7.05 m wide. The depth of the tank is limited by the cost of excavation and construction below the water table. A maximum allowable tank height of 3.0 m (SWD = 2.5 m, freeboard = 0.5 m) was selected. The capacity of the holding tank is approximately 240 m^3.

Assuming 100% solids capture in the gravity settlers and a gravity settler underflow solids concentration of 2%, the maximum underflow rate is estimated at:

828 kg/d / 0.02 / 1000 = 41.4 m^3/d

The holding tank provides approximately 5.8 days of storage at this peak sludge flow rate (in addition to the day of storage provided by the gravity settlers).

Under normal sludge flow conditions, the holding tank will provide significantly longer periods of storage.

Sludge Holding Tank Mixing Requirements

The Design Guidelines for Sewage Works do not specifically address the design of aerated sludge holding tanks, but the mixing requirement of 0.5 L/(m^3s) given for aerobic sludge digestion in Section 16.3.4 of the guidelines was applied to the design of the sludge holding tank.

The required air flow rate assuming the tank is filled to capacity is:

240 m^3 * 0.5 L/(m^3s) = 120 L/s (7.2 m^3/min)

The holding tank was equipped with two aeration blowers, each with a capacity of 5 – 10 m^3/min.

APPENDIX G

HYDRAULIC PROFILE CALCULATIONS

HEAD LOSS EQUATIONS

H_L = $K*(v^2/2g)$ *for point loss elements

where:
- **v** velocity through element (ft/s)
- **K** headloss coefficient
- **g** gravity (32.2 ft/s^2)

H_L = $0.0009015*2.31*L*(100/C)^{1.85}*(Q^{1.85}/D^{4.8655})$ *for pipe losses

where:
- **L** length of pipe run (ft)
- **C** Hazen-Williams pipe roughness/smoothness factor
- **Q** flow in pipe (gpm)
- **D** pipe inside diameter (in)

Manning's Eqn $Q = (1.49/n)*A*S_f^{1/2}$ *for open channel losses

$S_f = ((Q/A)/((1.49/n)*R_h^{2/3}))^2 = h_f/L$

where:
- **Q** flow (cfs)
- **n** roughness coefficient
- **A** area (ft2)
- **R_h** hydraulic radius
- **S_f** slope of energy gradeline (ft/ft)
- **hf** friction headloss (ft)
- **L** length of channel (ft)

Rect. Weir $Q = 3.33LH^{3/2}$ * for rectangular weir losses

where:
- **Q** flow (cfs)
- **L** length of weir (ft)
- **H** weir head (ft)

V-Notch Weir (90) $Q = 2.5H^{2.5}$ * for v-notch weir losses

where:
- **Q** flow per notch (cfs)
- **H** weir head (ft)

HYDARULIC PROFILE: PLANT OUTFALL - UV CHANNEL

---

1 Humber River Max. WS Level (100-Year) — 175.800 m

2 Required Plant Effluent Head — 175.800 m

Q = 11500 m3/d | 2110 gpm | 4.70 cfs

D = 600 mm | 1.97 ft

Loss Element	K Factor	D(ft)	Area (ft^2)	v (ft/s)	H_L (ft)	H_L (m)
exit	1	1.97	3.043	1.544	0.037	0.011
sharp entrance	0.5	1.97	3.043	1.544	0.019	0.006

Loss Element	C	D (ft)	Length (ft)	H_L (ft)	H_L (m)
conduit	140	1.97	40	0.013	0.004

3 Manhole 2 Max WS Elevation — 175.821 m

Q = 11500 m3/d | 2110 gpm | 4.70 cfs

D = 600 mm | 1.97 ft

Loss Element	K Factor	D(ft)	Area (ft^2)	v (ft/s)	H_L (ft)	H_L (m)
exit	1	1.97	3.043	1.544	0.037	0.011
90 deg bend	0.25	1.97	3.043	1.544	0.009	0.003
90 deg bend	0.25	1.97	3.043	1.544	0.009	0.003
sharp entrance	0.5	1.97	3.043	1.544	0.019	0.006

Loss Element	C	D (ft)	Length (ft)	H_L (ft)	H_L (m)
conduit	140	1.97	110	0.036	0.011

4 Manhole 1 Max WS Elevation — 175.855 m

Q = 11500 m3/d | 2110 gpm | 4.70 cfs

D = 600 mm | 1.97 ft

Loss Element	K Factor	D(ft)	Area (ft^2)	v (ft/s)	H_L (ft)	H_L (m)
exit	1	1.97	3.043	1.544	0.037	0.011

Loss Element	C	D (ft)	Length (ft)	H_L (ft)	H_L (m)
conduit	140	1.97	11	0.004	0.001

5 Flow Meter Exit Side Head — 175.867 m

Q = 11500 m3/d | 2110 gpm | 4.70 cfs

D1 = 600 mm | 1.97 ft

D2 = 300 mm | 0.98 ft

Loss Element	K Factor	D(ft)	Area (ft^2)	v (ft/s)	H_L (ft)	H_L (m)
open gate valve	0.15	1.97	3.043	1.544	0.006	0.002
pipe expansion	0.3	-	-	-	0.178	0.054
pipe/flow meter	-	0.98	0.761	6.178	-	-
pipe contraction	0.25	-	-	-	0.148	0.045
open gate valve	0.15	1.97	3.043	1.544	0.006	0.002
sharp entrance	0.5	1.97	3.043	1.544	0.019	0.006

Loss Element	C	D (ft)	Length (ft)	H_L (ft)	H_L (m)
conduit	140	1.97	12	0.004	0.001
conduit	140	0.98	9	0.086	0.026
conduit	140	1.97	3	0.001	3.00E-04

6	**Flow Meter Entrance Side Head/Process Water Sump Max WS Level**						**176.003**	**m**
	Q =	**11500**	**m3/d**	**2110**	**gpm**	**4.70**	**cfs**	
	Height of Weir Above Effluent Water Surface (m):					0.076	*from UV manufacturer	
	UV Effluent Weir EL =	**176.151**	**m**					
	UV Effluent Weir Headloss (m):					0.13	*from UV manufacturer	
7	**UV System Operating Level**						**176.281**	**m**

HYDARULIC PROFILE: UV CHANNEL - FILTER INFLUENT CHAMBER

---

7 UV System Operating Level — **176.281 m**

Q = **11500** m3/d | **2110** gpm | **4.70** cfs

Channel Base = 175.781 m

Overhead Floor = 176.949 m

*from UV manufacturer: Base of the UV channel is 0.37 m lower than the top of the effluent weir. The overhead floor sits 0.798 m above the top of the weir.

Loss Element	K Factor	Area (ft^2)	v (ft/s)	H_L (ft)	H_L (m)	
entrance	0.5	2.319	2.027	0.032	0.010	*square entrance

Loss Element	n	Depth (ft)	Width (ft)	Area (ft^2)	Rh (ft)	Length (ft)	H_L (ft)	H_L (m)
open channel	0.013	2.02	1.50	3.031	0.547	47.9	0.020	0.006

*from NoPhos drawing: Base of filter effluent channel is 0.766 m below the top of the effluent weir. Depth of water in the channel is set such that the top of the weir is 0.15 m above the water surface in the channel.

8 Filter Effluent Channel Max. Water Surface Elevation — **176.297 m**

Q per weir = **2875** m3/d | **527** gpm | **1.18** cfs

Height of Weir Above Effluent Water Surface (m): 0.15 *assumed

Stage 2 Effluent Weir EL = 176.482 m

Filter Base = 171.882 m

*from NoPhos: The base of the second stage filter is 4.6 m lower than the top of the effluent weir.

Rectangular Weir Headloss:	L (ft)	H_L (ft)	H_L (m)
	6	0.1512	0.0461

9 Filter 2 Operating Level — **176.493 m**

Q per train = **2875** m3/d | **527** gpm | **1.18** cfs

D = **250** mm | **0.82** ft

Stage 2 Filter Headloss at PHF (m): 0.8 *from ı (plus 10 cm)

Loss Element	K Factor	D(ft)	Area (ft^2)	v (ft/s)	H_L (ft)	H_L (m)
sharp entrance	0.5	0.82	0.528	2.224	0.038	0.012

10 Filter 1 Effluent Box WS Elevation — **177.304 m**

Q per weir = **2875** m3/d | **527** gpm | **1.18** cfs

Filter Base (from above): 171.882 m

*Assuming stage 1 and 2 filter bases will sit at the same level.

Stage 1 Effluent Weir EL = 177.492 m

*from NoPhos drawing: The top of the weir of the first stage filter is 5.61 m higher than the base of the filter.

Top of Weir to Effluent WS Elevation (m) = 0.188

Rectangular Weir Headloss:	L (ft)	H_L (ft)	H_L (m)
	6	0.1512	0.0461

11 Filter 1 Operating Level — **177.539 m**

Q per train =	**2875**	**m3/d**	**527**	**gpm**	**1.18**	**cfs**
D =	**250**	**mm**	**0.82**	**ft**		

Stage 1 Filter Headloss at PHF (m): 0.9 *from NoPhos (plus 10 cm)

Loss Element	K Factor	D(ft)	Area (ft^2)	v (ft/s)	H_L (ft)	H_L (m)
sharp entrance	0.5	0.82	0.528	2.224	0.038	0.012
open gate valve	0.15	0.82	0.528	2.224	0.012	0.004

Q per trough=	**5750**	**m3/d**	**1055**	**gpm**	**2.35**	**cfs**

Loss Element	n	Depth (ft)	Width (ft)	Area (ft^2)	Rh (ft)	Length (ft)	H_L (ft)	H_L (m)
open channel	0.013	5.55	3.28	18.215	1.266	47.9	1.11E-05	3.38E-06

12 Filter Influent Channel Max. Water Surface Elevation — **178.454 m**

Q per opening =	**5750**	**m3/d**	**1055**	**gpm**	**2.35**	**cfs**

Loss Element	K Factor	Area (ft^2)	v (ft/s)	H_L (ft)	H_L (m)	
exit/entrance	1.5	1	2.350	0.129	0.039	*square opening

13 Mixing Tank WS Elevation — **178.493 m**

HYDRAULIC PROFILE: FILTER INFLUENT CHAMBER - SECONDARY EFFLUENT WEIRS

14A Head at Mixing Tank Inlet A (from NEW SECONDARY) 178.493 m

Q = 6670 m3/d 1224 gpm 2.73 cfs

D = 400 mm 1.31 ft

Loss Element	K Factor	D(ft)	Area (ft^2)	v (ft/s)	H_L (ft)	H_L (m)
exit	1	1.31	1.353	2.015	0.063	0.019
90 deg bend	0.25	1.31	1.353	2.015	0.016	0.005
90 deg bend	0.25	1.31	1.353	2.015	0.016	0.005
90 deg bend	0.25	1.31	1.353	2.015	0.016	0.005
45 deg bend	0.18	1.31	1.353	2.015	0.011	0.003
45 deg bend	0.18	1.31	1.353	2.015	0.011	0.003
sharp entrance	0.5	1.31	1.353	2.015	0.032	0.010

Loss Element	C	D (ft)	Length (ft)	H_L (ft)	H_L (m)
conduit	140	1.31	160	0.138	0.042

15A WS Elevation Downstream of Secondary Effluent Weir (NEW SECONDARY) 178.585 m

Effluent Weir Elevation (top of weir) = 178.900 m

Top of Weir to Effluent WS Elevation (m) = 0.315

14B Head at Mixing Tank Inlet B (from EXISTING SECONDARY) 178.493 m

Q = 4830 m3/d 886 gpm 1.97 cfs

D = 400 mm 1.31 ft

Loss Element	K Factor	D(ft)	Area (ft^2)	v (ft/s)	H_L (ft)	H_L (m)
exit	1	1.31	1.353	1.459	0.033	0.010
90 deg bend	0.25	1.31	1.353	1.459	0.008	0.003
90 deg bend	0.25	1.31	1.353	1.459	0.008	0.003
90 deg bend	0.25	1.31	1.353	1.459	0.008	0.003
45 deg bend	0.18	1.31	1.353	1.459	0.006	0.002
45 deg bend	0.18	1.31	1.353	1.459	0.006	0.002
sharp entrance	0.5	1.31	1.353	1.459	0.017	0.005

Loss Element	C	D (ft)	Length (ft)	H_L (ft)	H_L (m)
conduit	140	1.31	105	0.050	0.015

15B WS Elevation Downstream of Secondary Effluent Weir 178.534 m

Effluent Weir Elevation (bottom of V-notch) = 178.706 m

Bottom of V-notch to Effluent WS Elevation (m) = 0.172

HYDRAULIC PROFILE: NEW SECONDARY TREATMENT SYSTEM

Q_1 =	6,676	m^3/day	2.73	ft^3/s	1225	gpm
Q_2 =	3,338	m^3/day	1.36	ft^3/s	612	gpm
Q_3 =	5,007	m^3/day	2.05	ft^3/s	919	gpm
Q_4 =	40	m^3/day	0.0162	ft^3/s	7.29	gpm
Q_5 =	1,669	m^3/day	0.6822	ft^3/s	306	gpm

16A Starting at launder weirs in the clarifier — 178.900 m

Rectangular weir	L (ft)	H (ft)	H (m)
	78.74016	0.0302	0.0092

17A Clarifier (top of weir) — 178.909 m

Loss Element	K Factor	D(ft)	Area (ft^2)	v (ft/s)	H_L (ft)	H_L (m)
Exit (3)	1	1.312	1.353	0.504	0.004	0.0012
90° pipe bend (4)	1	1.312	1.353	0.504	0.004	0.0012
Entrance (3)	0.5	1.312	1.353	0.504	0.002	0.0006

Loss Element	C	D (ft)	Length (ft)	H_L (ft)	H_L (m)
Conduit (3)	140	1.312	15.584	0.003	0.0009

Contigency loss	0.1

18A Aeration Tank Effluent — 179.013 m

See attached calculation for this segment of hydraulic profile
Calculation based on conservation of energy, because open chanel, uniform flow exists

19A End of parshall flume elevation — 179.036 m

Channel bottom increases to 179.12 m					179.12 m
Parshall flume loss			0.366	m	179.486 m

Loss Element	K Factor	D(ft)	Area (ft^2)	v (ft/s)	H_L (ft)	H_L (m)
Exit	1	1.312	1.353	2.017	0.063	0.0193
90° Pipe bend (1)	0.25	1.312	1.353	2.017	0.016	0.0048
Entrance	0.5	1.312	1.353	2.017	0.032	0.0096

Loss Element	C	D (ft)	Length (ft)	H_L (ft)	H_L (m)
Conduit	140	1.312	160	0.138	0.0421

20A New distribution chamber (Downstream of the weir) — 179.562 m

HYDRAULIC PROFILE: EXISTING SECONDARY TREATMENT SYSTEM

Q_1 =	4,820	m^3/day	1.97	ft^3/s	884	gpm
Q_2 =	2,410	m^3/day	0.99	ft^3/s	442	gpm
Q_3 =	7,230	m^3/day	2.96	ft^3/s	1326	gpm
Q_4 =	45	m^3/day	0.0184	ft^3/s	8.26	gpm

16B Bottom of the V-notch Elevation) 178.706 m

V-Notch weirs		H (ft)	H (m)		
107		0.140238	0.04274	178.749	<178.756

Clarifier Influent Pipe

Loss Element	K Factor	D(ft)	Area (ft^2)	v (ft/s)	H_L (ft)	H_L (m)
Exit	1	0.820	0.528	1.864	0.054	0.0165
90° Pipe bend (2)	0.50	0.820	0.528	1.864	0.027	0.0082
Entrance	0.5	0.820	0.528	1.864	0.027	0.0082

Loss Element	C	D (ft)	Length (ft)	H_L (ft)	H_L (m)
Conduit	100	0.820	22.966	0.0552	0.0168

Starting at Aeration Influent Channel 178.798 m <178.815

Starting at rectangular weir in the aeration Tank (weir elevation) 178.9 m

Rectangular weir	L (ft)	H (ft)	H (m)
	19.521	0.1281	0.0391

17B Aeration Tank Effluent (top of weir) 178.939 m

Piping between existing distribution chamber and aeration tank (Invert at pipe exit) 179.079 m

Loss Element	K Factor	D(ft)	Area (ft^2)	v (ft/s)	H_L (ft)	H_L (m)
Exit	1	0.984	0.761	2.589	0.104	0.0317
Wye	0.5	0.984	0.761	2.589	0.052	0.0159
45° Pipe bend (3)	0.54	0.984	0.761	2.589	0.056	0.0171
Entrance	0.5	0.984	0.761	2.589	0.052	0.0159

Loss Element	C	D (ft)	Length (ft)	H_L (ft)	H_L (m)
Conduit	140	0.984	161.417	0.3091	0.0942

Flow distribution chamber elevation (assuming full pipe): 179.254 m

A full pipe flow condition may not exist. Use Manning's Equation and Circular Channel Ratios to check:

Determine Qfull (s = 0.00043, A = 0.761 sf, Rh = 0.984/4, n=0.013)

Qfull = 0.70977 Therefore pipe will be in full pipe flow

Elevation will be top of pipe (179.4) plus head losses

18B Flow distribution chamber elevation: 179.5748 m

Starting at rectangular weir in Flow Distribution Box 179.81 m

Note that box is being modified to extend weir from 260 mm to 2100 mm

Rectangular weir	L (ft)	H (ft)	H (m)
	6.889764	0.1958	0.0597

19B Distribution Box Inlet 179.870 m

Loss Element	K Factor	D(ft)	Area (ft^2)	v (ft/s)	H_L (ft)	H_L (m)
Exit	1	1.312	1.353	1.456	0.033	0.0100
Entrance		1.312	1.353	1.456		

Loss Element	C	D (ft)	Length (ft)	H_L (ft)	H_L (m)
Conduit	140	1.312	161.417	0.0763	0.0232

20B Flowmeter chamber at downstreamside elevation 179.903 m

Loss Element	K Factor	D(ft)	Area (ft^2)	v (ft/s)	H_L (ft)	H_L (m)
Exit		1.312	1.353	1.456		
Tee (flow through)	1.5	1.312	1.353	1.456	0.049	0.0151
Pipe Expansion	0.25	1.312	1.353	1.456	0.008	0.0025
Valve	0.15	0.984	0.761	2.589	0.016	0.0048
Valve	0.15	0.984	0.761	2.589	0.016	0.0048
Pipe Contractio	0.60	0.984	0.761	2.589	0.063	0.0192
Entrance		1.312	1.353	1.456		

Loss Element	C	D (ft)	Length (ft)	H_L (ft)	H_L (m)
Conduit	140	0.98425	16	0.031	0.0093
conduit	140	1.312	6	0.003	0.0009

21B Flowmeter chamber at entrance elevation 179.959 m

Loss Element	K Factor	D(ft)	Area (ft^2)	v (ft/s)	H_L (ft)	H_L (m)

Exit	1	1.312	1.353	1.456	0.033	0.0100
90° Pipe bend	0.00	1.312	1.353	1.456	0.000	0.0000
Entrance		1.312	1.353	1.456		

Loss Element	**C**	**D (ft)**	**Length (ft)**	**H_L (ft)**	**H_L (m)**
conduit	140	1.312	10.23	0.005	0.0015

22B **New distribution chamber (downstream of the weir)** **179.971** **m**

HYDRAULIC PROFILE: NEW DISTRIBUTION CHAMBER

22 New distribution chamber (Downstream of the weir) 179.971 m

Difference between the top elevation and the hydraulic elevation downstream of the weir in the new distribution chamber:
0.155 m

23 Top of the weir in the new distribution chamber 180.126 m

Rectangular weir 0.297 m
See attached calculation

24 Water surface elevation at entrance to distribution chamber 180.423 m

Loss Element	K Factor	D(ft)	Area (ft^2)	v (ft/s)	H_L (ft)	H_L (m)
Exit	1	1.312	1.353	2.017	0.063	0.0193
90° Pipe bend (2)	0	1.312	1.353	2.017	0.000	0.0000
Entrance	0.5	1.312	1.353	2.017	0.032	0.0096

Loss Element	C	D (ft)	Length (ft)	H_L (ft)	H_L (m)
Conduit	140	1.312	16	0.014	0.0042

25 Water Surface at exit to Existing Headworks Building 180.456 m

APPENDIX H

HYDRAULIC MODELLING INPUT AND OUTPUT

(CD Enclosed)

APPENDIX I

PROCESS NARRATIVE

PROCESS NARRATIVE

ACME Wastewater Treatment Plant Expansion

Anytown, Ontario



Submitted to:
The City of Anytown
321 Avenue Road
Anytown, Ontario
C3B 2A1

Prepared by:
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123 Office Drive
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August 11, 2009

City of Anytown

ACME Wastewater Treatment Plant

CONSULTING LTD.

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APPENDIX J

GEOTECHNICAL REPORT

SoilTECH

GEOTECHNICAL INVESTIGATION

Proposed ACME WWTP Expansion

Anytown, Ontario

Submitted to: Consulting Ltd.

Date: July 2, 2008

SoilTECH

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APPENDIX A

Boreholes Logs	Enclosures 1 to 7

1.0 INTRODUCTION

SoilTECH was retained by Consulting Ltd. on behalf of the City of Anytown, to carry out a geotechnical investigation at the locations of proposed expansions at the existing ACME Wastewater Treatment Plant (WWTP). The facility is located at 1098 Boulevard Road in the City of Anytown, Ontario (Site). A map of the site location is provided as Figure 1.

It is our understanding that the proposed expansion to the facility will include new wastewater treatment equipment and will consist of the following components:

- Odour control and sludge handling facility;
- Aeration basins;
- Secondary clarifiers;
- RAS/WAS structure; and
- UV and Tertiary Treatment Building.

This report contains a description and findings of our geotechnical investigation, as well as professional opinions and recommendations regarding subsurface conditions and the design and construction of building foundations and floor slabs for the proposed new wastewater treatment equipment upgrades, and pavement design for the new access driveway. The anticipated construction conditions pertaining to excavation, temporary groundwater control and backfilling are discussed also, but only with regard to how these might influence the design.

2.0 FIELD PROCEDURES

The scope of work included drilling seven (7) boreholes to depths varying between 5.2 m and 9.8 m below existing grades to confirm subsurface conditions within the proposed area of development. The borings were advanced on June 2 and 3, 2008. Five (5) boreholes were drilled to a depth of 9.8 m and two (2) boreholes were to a depth of 5.2 m below grades at the locations shown on Figure 2. The following is a summary of all borehole locations within the Site:

2.1 Location	Borehole No.	Borehole Depth (m)
UV/Tertiary Treatment Building	1, 2	5.2
Secondary Clarifiers	3	9.8
Aeration Basins	4, 5	9.8
Odour Control/Sludge Handling Building	6,7	9.8

The detailed results of the individual boreholes are recorded on the attached borehole logs. The stratigraphy at each borehole location has been referenced to the current grade level. Also, the ground surface elevations at the borehole locations have been surveyed to a geodetic elevation provided by Consulting Ltd. The benchmark was identified as the north cut cross on the north side of the bridge (east end), adjacent to the Site entry gate. The benchmark had a geodetic elevation of 179.376 m.

The drilling work was carried out by a drilling contractor under the full-time supervision of an SoilTECH technician. The borings were advanced using a continuous flight power auger machine using hollow stem augers. The supervising technician logged the borings and examined the samples as they were obtained. The samples of the strata penetrated were collected using the Split-Barrel Method (ASTM D1586). The samples obtained were sealed in clean, airtight containers and transferred to the SoilTECH laboratory where they were reviewed by a geotechnical engineer.

Groundwater observations were made in the boreholes during and upon completion of drilling. Three standpipe-type piezometers (Borehole 1, 4 and 6) were installed at the Site and comprised of 19 mm I.D. threaded pipe with a 1.5 m length of screen, and fitted with a sand filter and bentonite seal as detailed on the respective borehole logs provided in Appendix A. Geotechnical laboratory

testing consisted of moisture content tests on all recovered samples, and grain size distribution analysis on four (4) representative samples. The results of the moisture content determinations are recorded on the borehole logs at the corresponding depths. The grain size results are provided as Figure 3, 4, 5, and 6.

3.0 SUBSURFACE CONDITIONS

Details of the subsurface conditions encountered at the site are summarized below and are also presented on the attached borehole. It should be noted that the subsurface conditions are confirmed at the borehole locations only, and may vary at other locations. The boundaries between the various strata, as shown on the borehole logs, are based on non-continuous sampling. These boundaries represent an inferred transition between the various strata, rather than a precise plane of geological change.

3.1 Grass Vegetation/Topsoil

A surficial layer of grass vegetation/topsoil was encountered at the ground surface in all boreholes except Borehole 7. The thickness of the topsoil layer generally ranged from 50 mm to 300 mm.

3.2 Earth Fill

An earth fill layer was encountered at the ground surface in Borehole 7 and immediately beneath the surficial topsoil in all remaining boreholes and extended to depths ranging from 0.8 m to 1.6 m below existing grade. The earth fill was observed to be variable in composition consisting primarily of sand and gravel but locally varied to silty sand with some gravel and silty clay to clayey silt in some locations. The earth fill layer was found to have a variable density with standard penetration test results (SPT 'N' values), obtained using standard sampling procedures on all recovered samples, ranging from 1 blow to 20 blows per 300 mm of penetration, indicating a very loose/firm to compact condition. The moisture content of fill samples extracted from the borings generally varied between 14 and 26 percent by weight, indicating a damp to wet condition.

3.3 Native Sand

A layer of native sand, silty sand or sand and gravel was encountered beneath the earth fill in Boreholes 3, 4, 5, and 6, at a depth of 0.8 to 1.5 m and extended to a depth of 2.0 to 2.4 m below grade. The native sand deposit was found to be in a compact to very dense condition with standard penetration test results ranging between 15 and 50 blows per 300 mm of penetration. Also, the sand deposit became wet with increased depth below grade.

A grain size analysis was carried out on one representative sample of the native sand deposit. The result of this test is presented in the following table and is also presented as Figures 5.

Sample No./Depth	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
BH-5, SS3 / 1.5 to 2.1 m	0	4	41	44

3.4 Clayey Silt

The undisturbed stratigraphy at this site is a clayey silt stratum that locally varies to silty clay and silt some clay. The stratum was encountered immediately beneath the earth fill layer in Boreholes 1 and 2 at a depth of 0.8 and 1.6 m below grade and beneath the native sand layer in Boreholes 3, 4, 5, 6, and 7 at a depth of 2.0 to 2.4 m, and extended to the depth of investigation, i.e. 5.2 to 9.8 m below grade. The clayey silt deposit was observed to contain seams and layers of wet fine sand, and traces of embedded sand and gravel.

The penetration resistance measured in the clayey silt stratum by standard sampling procedures yielded variable results ranging from 15 to 52 blows per 300 mm of penetration. The consistency of the stratum was generally stiff to hard.

The clay and silt soils were observed to be in a moist to wet state. Moisture content of samples extracted from the boreholes varied between 10 and 29 percent by weight. Grain size distribution analyses were carried out on three (3) representative samples of the native deposits. The results of these tests are presented in the following table and are also presented as Figures 3, 4, and 6.

Sample No./Depth	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
BH-1, SS6 / 0.8 to 1.2 m	21	67	12	0
BH-3, SS7 / 6.1 to 6.7 m	22	69	10	0
BH-6, SS6 / 4.6 to 5.2 m	18	63	18	0

3.5 Groundwater

Groundwater observations were made in each of the boreholes as they were drilled. In addition, standpipe type piezometers were installed into Boreholes 1, 4 and 6 in order to permit observation of the groundwater levels. A summary of the water levels in the open borings upon completion of drilling and in the piezometers several days following drilling is summarized below. Water level measurements were taken in the piezometers on June 10, 2008.

Borehole No.	Depth of Borehole (m)	Depth of Water Level in Open Boring (m)[1]	Water Level / Elevation in Standpipe on June 10, 2008
1	5.2	Dry	0.4 m / 177.0 m
2	5.2	Dry	-
3	9.8	Dry	-
4	9.8	Dry	1.2 m / 177.3 m
5	9.8	8.1	-
6	9.8	1.3	2.0 m / 178.6 m
7	9.8	Dry	-

[1]At the time of investigation it was reported that pumps at the south end of the site were dewatering an excavation that was part of an ongoing construction activity. It was reported that the pumps were discharging approximately 43 m3/day It should be noted that groundwater levels are transient and tend to fluctuate with the seasons and periods of precipitation and temperature.

4.0 ENGINEERING DISCUSSION AND ASSESSMENT

4.1 General

It is our understanding that the proposed expansion to the facility will include new wastewater treatment equipment and will consist of the following components:

- Odour control and sludge handling facility;
- Aeration basins;
- Secondary clarifiers;
- RAS/WAS structure; and
- UV and Tertiary Treatment Building.

In addition a new driveway will be constructed to provide access to the upgraded facility. Based upon the above comments and on the borehole information, and assuming them to be representative of the subsoil conditions across the Site, the following comments and recommendations are offered.

4.2 Site Preparation and Grading

At the time of our investigation, the ground surface was found to be overlain with some vegetation or bare earth overlying earth fill that extends to 0.8 to 1.6 m below grade. As a result some topsoil stripping and cut and fill activity will need to be carried out to facilitate Site development.

The surficial topsoil containing rootlets, organics, and vegetation and any earth fill materials found to contain significant amounts of organics should be removed from the Site prior to site grading activities and should not be used as backfill in settlement sensitive areas. The topsoil thickness across the Site was generally 50 mm to 300 mm.

The shallow earth fill and native soils are considered suitable for reuse as backfill to raise site grades where required, provided it is free of organic material and is within the optimum moisture content. It is noted that the earth fill contained traces of intermixed topsoil. If a significant amount of intermixed topsoil is encountered during Site grading activities the fill in these locations may not be suitable for re-use in settlement sensitive areas. Care will be required to examine the earth fill quality during grading activities and any materials found to contain significant topsoil should be removed. Also, based on laboratory water content

measurements and visual examination of soil samples extracted from the borings, the native soils and earth fill materials are generally within acceptable moisture content limits for effective compaction. Materials found to be wet may need to be left aside to dry, mixed with drier material, or used as fill in non-settlement sensitive areas.

The existing fill is generally suitable to remain in place to support engineered fill placement, floor slabs and pavements structures. It is recommended that the exposed subgrade soils be visually inspected and proof rolled using large axially loaded equipment prior to filling. Any soft, organic, or unacceptable areas should be removed as directed by the Engineer and replaced with suitable fill materials compacted to a minimum of 98% Standard Proctor Maximum Dry Density (SPMDD).

If imported materials are required to raise grades on Site then chemical tests on the imported fill materials should be made available to the Owner to ensure that the fill source meets applicable MOE standards.

All fill placed in proposed pavement and building areas as part of Site grading activities should be placed in large areas where it can be compacted by a heavy sheepsfoot type roller to 98 percent SPMDD.

4.3 Foundation Design Parameters

Building foundations at the Site can consist of conventional spread footings or augered piers founded on the native soils. No adverse soil conditions were encountered at the Site that will result in deepened footings. It is noted that some groundwater seepage will be encountered during shallow excavation activity and dewatering will be required. Requirements for groundwater control are described in more detail below and in Section 5.1.

4.3.1 Conventional Spread Footings on Native Soils

Where undisturbed native clayey silt and sand deposits coincide with the foundation level appropriate for the structures, the proposed buildings can be supported on conventional shallow spread footing foundations. A maximum net allowable bearing pressure of 200 kPa for a Service Limit State (SLS) design and 300 kPa for an Ultimate Limit State (ULS) design is recommended for the design of spread footings established on the very stiff to hard or compact to dense

native stratum. It is recommended that the minimum footing width for spread footings be 450 mm.

The minimum founding depth at each of the borehole locations is summarized in the table below. Footings must be founded at least 0.3 metre into the undisturbed glacial till for the allowable bearing capacity values provided.

Borehole No.	Minimum Founding Depth Below Existing Grade / Elevation
1	1.1 m / 176.3 m
2	2.3 m / 175.8 m
3	1.5 m / 177.1m
4	1.5 m / 177.0 m
5	1.5 m / 178.1m
6	1.8 m / 178.7 m
7	1.8 m / 178.8 m

The settlement of spread footings established on the clayey silt till and native sand deposit at this design bearing pressure is expected to be less than 25 mm.

It is noted that seepage is anticipated in the excavations from surface drainage and seepage from any preferentially permeable features in the soil, such as the cohesionless earth fill layer, the shallow native sand deposits, and any sand layers found within the native deposits. Groundwater measured in the three piezometers installed across the Site had levels that were 0.4 to 2.0 m below grade and water seepage into the open borings at the time of drilling generally occurred at depths of 0.8 to 2.3 m below grade. Since the earth fill and shallow native soils at the Site comprise of cohesionless deposits, it is possible that sustained pumping from filtered sumps may be required if groundwater seepage is encountered during construction. If excavations are carried out more than 0.3 m below the water table then considerations should be given to utilizing well points. An expert dewatering contractor should be consulted to provide advice on appropriate dewatering techniques.

Footings exposed to freezing temperatures must be provided with at least 1.2 metres of earthcover for frost protection or equivalent insulation.

4.3.2 Drilled Pier Foundations on Native Soils

Drilled piers can be made to bear in the undisturbed native clayey silt and sand deposits at depths shown in the table above, and sized based on a maximum net allowable end bearing pressure of 200 kPa for a Service Limit State (SLS) design and 300 kPa for an Ultimate Limit State (ULS) design. The minimum size of the drilled piers is 760 mm diameter to allow for adequate access for workman to enter and hand clean the caisson base, prior to placing concrete. The drilled shaft construction will require the use of a temporary liner so that workers and inspection personnel can enter the drilled shaft. Auger cleaning of the foundation bases alone will not be adequate. If higher bearing capacities are required then SoilTECH should be consulted.

4.4 Slab on Grade Design Parameters

Depending on the final site grading levels selected for the proposed buildings, the subgrade for slab-on-grade construction will consist of native soils, engineered fill used to raise Site grades, or existing on-site fill materials. These materials constitute an adequate subgrade for support of the slab on grade. Prior to any construction or Site filling, the subgrade soils beneath the proposed floor slab should be cut neatly to grade and the area should be proof rolled using large axially loaded equipment. Any soft or unacceptable areas be removed as directed by the Engineer and replaced with suitable fill materials. Any new fill utilized to raise grades beneath slabs should be placed and compacted in accordance with Section 4.2.

The floor slab should be founded on a 200 mm thick granular base layer consisting of well graded granular material, such as Granular 'A' (OPSS 1010). A capillary moisture barrier can be made by placing the slab on a minimum 200 mm layer of 19 mm stone (OPSS 1004), instead of the Granular ‘A’ layer described above, and compacted by vibration to a dense state. Alternatively, a polyethylene barrier can be considered, but care must be taken to ensure that the barrier is not damaged during concrete placement. It should be noted however, that the polyethylene generally has a negative impact on the quality of slab finish that can be achieved. The polyethylene barrier should be not less than 6 mil and must be supported by a layer of well-graded granular material to provide uniform support for the slab.

The modulus of subgrade reaction appropriate for slab design would depend on the condition of the subgrade fill and the extent of subexcavation required. If all

unsuitable materials are removed beneath the proposed slab-on-grade and replaced with well compacted engineered fill or if the subgrade consists of competent native till soils then a modulus of subgrade reaction of 27,000 kN/m3 (100 pci) can be used for design purposes. Provision of nominal subfloor drainage is recommended regardless of the alternative selected for capillary moisture control. Perimeter drainage of the structure is recommended where there is pavement adjacent to the building face or finished floor level in the structure is not at least 200 mm above the prevailing exterior grade level. Surface drainage should be directed away from the building.

4.5 Site Servicing and Backfilling

Underground municipal water and sewers can be founded on either undisturbed native soils or engineered fill. These materials will provide adequate support of buried services on conventional well-graded granular bedding. The use of clear stone such as HL 8 coarse aggregate is not recommended for this Site unless the bedding material is wrapped entirely with a suitable geotextile to prevent the migration of fines into the stone. The bedding for trenched services should consist of material meeting City of Anytown specifications. The bedding and sand cover materials should be adequately compacted to provide support and protection to the service pipes.

Where disturbance of the trench base has occurred, such as due to groundwater seepage, or construction traffic, the disturbed soils should be sub-excavated and replaced with suitably compacted granular fill.

Backfilling of trenches can be accomplished by reusing the excavated soils or similar fill material provided the moisture content is maintained within 2 percent of optimum. The fill material and shallow native till encountered in the boreholes were considered to be suitable for re-use on the site. All backfill material should be free of deleterious material and placed in loose lift thicknesses not exceeding 150 mm and compacted to not less than 98 percent SPMDD. All trenches must be widened sufficiently to accommodate the appropriate compaction equipment.

Depending on the depth of trench excavation, and groundwater conditions at the time of excavation, groundwater infiltration should be expected. Minor subsurface seepage from wet seams and any surface runoff should be readily handled by using sump pumps within the excavations and by grading the area to control site drainage. If excavations are carried out more than 0.3 m below the water table

then considerations should be given to utilizing well points. An expert dewatering contractor should be consulted to provide advice on appropriate dewatering techniques.

4.6 Pavement Design

Based on the type and frequency of traffic that is anticipated for the Site, the following pavement component thickness may be used for the design of the proposed access driveway. Since the driveway will receive minimal use it is assumed that an aggregate surfaced roadway will be used.

Pavement Layer	Compaction Requirements	Light Duty Pavement Design (Car Parking)
Base Course: 19mm Crusher Run	100% Standard Proctor Maximum Dry Density	200mm
Subbase Course: Granular B or 50mm Crusher Run	98% Standard Proctor Maximum Dry Density	300mm

It is anticipated that the pavement subgrade will consist of undisturbed native soils, existing earth fill, or engineered fill placed during site grading activities. Where undisturbed native soil is encountered at subgrade level it is recommended that the soil be cut neatly to grade. The area should be proof rolled using large axially loaded equipment and any soft or unacceptable areas be removed as directed by the Engineer and replaced with suitable fill materials compacted to a minimum of 98% SPMDD.

Where there is existing fill on the site, caution needs to be exercised in the preparation of the subgrade on this material because there is no evidence to suggest it has been compacted. It is recommended that any subgrades comprised of existing fill be inspected for obvious soft or loose areas. Should such areas be found, SoilTECH can provide appropriate advice for addressing local weak areas at that time. If new fill is required to raise the grade, selected on-site fill could be used, provided it is free of any organic material or shale fragments larger than 150 mm size. The fill should be placed in large areas where it can be compacted by a heavy sheepsfoot type roller. Any fill placed to increase or level the grade must be compacted to a minimum 98 percent SPMDD in lifts not exceeding 150 mm.

In-situ density testing to monitor the effectiveness of the compaction equipment in achieving the required densities is also recommended. It is noted that a granular pavement constructed on top of the existing fill will likely result in some settlement of the finished surface. Subgrade inspection and removal of unsuitable or soft material will be an important operation to minimize pavement settlement. Also, periodic maintenance typical of granular pavements will be required every few years to maintain serviceability. This could include regarding of the surface to maintain the pavement profile and placement of additional granular material as required in areas where settlements occurs.

5.0 DESIGN CONSIDERATIONS

5.1 Excavation and Temporary Shoring

Excavations must be carried out in accordance with the *Occupational Health and Safety Act and Regulations for Construction Projects*. These regulations designate four broad classifications of soils to stipulate appropriate measures for excavation safety. The fill material encountered at this site is considered to be a Type 3 soil and the undisturbed native sand and clayey silt is considered to be a Type 2 soil. Where workers must enter a trench or excavation carried deeper than 1.2 metres the trench or excavation must be suitably sloped and/or braced in accordance with the regulation requirements. The regulation stipulates maximum slopes of excavation by soil type as follows:

Soil Type	Base of Slope	Maximum Slope Inclination
1	within 1.2 metres of bottom of trench	1 horizontal to 1 vertical
2	within 1.2 metres of bottom of trench	1 horizontal to 1 vertical
3	from bottom of trench	1 horizontal to 1 vertical
4	from bottom of trench	3 horizontal to 1 vertical

Minimum support system requirements for steeper excavations are stipulated in Sections 235 through 238 and 241 of the Act and Regulations and include provisions for timbering, shoring and moveable trench boxes. It is noted that seepage is anticipated in the excavations from surface drainage and seepage from any preferentially permeable features in the soil, such as the cohesionless earth fill layer, the shallow native sand deposits, and any sand layers found within the native deposits.

Groundwater measured in the three piezometers installed across the Site had levels that were 0.4 to 2.0 m below grade and water seepage into the open borings at the time of drilling generally occurred at depths of 0.8 to 2.3 m below grade. Since the earth fill and shallow native soils at the Site comprise of cohesionless deposits, it is possible that sustained pumping from filtered sumps may be required if groundwater seepage is encountered during construction. If excavations are carried out more than 0.3 m below the water table then considerations should be given to utilizing well points. An expert dewatering

contractor should be consulted to provide advice on appropriate dewatering techniques.

For the design of temporary support works, such as shoring, the applicable soil properties that could be considered appropriate in this design analysis are presented below. If ground movements are to be limited, we recommend the use of the K_0 earth pressure coefficient instead of the K_a value.

Soil	Φ	γ (kN/m³)	K_a	K_o	K_p
Compact Sand	32	20	0.31	0.47	3.23
Stiff to very stiff Clayey Silt to Silt	30	21	0.33	0.50	3.00

5.2 Site Work

Topsoil was encountered in six of the seven boreholes at the ground surface. The thickness of topsoil generally varied at the borehole locations between 50 mm and 300 mm, as shown on the borehole logs. It is noted that the assessment of topsoil thickness is subject to interpretation. Also, it can be anticipated that tree removal will likely result in the stripping of more soil than that noted in the boreholes.

The soil at this site is fine-grained (primarily clayey silt) and will become weakened when subjected to traffic when wet. If there is site work carried out during periods of wet weather, then it can be expected that the subgrade will be disturbed unless an adequate granular working surface is provided to protect the integrity of the subgrade soils from construction traffic. Subgrade preparation work cannot be adequately accomplished during wet weather, and the project must be scheduled accordingly. If a clear stone capillary moisture barrier is selected for the underfloor design, this material has poor stability under wheel loading and can be an impediment to other site activities such as steel and mechanical erection. If this is the case, substitution of the upper 50 mm with compacted Granular ‘A’ to provide a travel surface constitutes no technical compromise to the capillary barrier effect intended.

If construction proceeds during freezing weather conditions, adequate temporary frost protection for the exposed soil in the foundation excavations is required.

The soil at this site is susceptible to frost damage. Consideration must be given to frost effects, such as heave or softening, on exposed surfaces.

5.3 Construction Monitoring

The proposed structures will either be founded on conventional spread footing, and/or drilled pier foundations. The foundation installations must be monitored and evaluated by qualified personnel to ensure that the founding achieved is consistent with the design bearing intended by the geotechnical engineer. The on-site review of the condition of the foundation soil as the foundations are constructed is an integral part of the geotechnical design function and is required by Section 4.2.2.2 of the Ontario Building Code 2006.

All backfilling should be supervised to ensure that proper materials are employed and that adequate compaction is achieved. Strict quality control guidelines should be followed during the placement of fill materials.

The performance of the pavement structure is highly dependent upon the subgrade support conditions. Stringent construction control procedures should be maintained to ensure that uniform subgrade moisture and density conditions are achieved as much as practically possible. The most severe loading conditions on pavement areas and the subgrade may occur during construction. Consequently, special provisions such as restricted lanes, half-loads during paving, etc., may be required, especially if construction is carried out during unfavourable weather.

6.0 LIMITATIONS OF THE INVESTIGATION

This report is intended solely for the client named. The material in it reflects our best judgement in light of the information available to SoilTECH at the time of preparation. No portion of the report may be used as a separate entity, it is intended to be read in its entirety. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties.

The recommendations made in this report are in accordance with our present understanding of the project. We request that we be permitted to review our recommendations when the drawings and specifications are complete, or if the proposed construction should differ from that mentioned in this report.

It is also to emphasize that a soil investigation, is, in fact, a random sampling of a Site and the comments are based on the results obtained at the test locations only. It is therefore, assumed that these results are representative of the subsoil conditions across the Site. Should any conditions at the Site be encountered which differ from those found at the test locations, we request that we be notified immediately in order to permit a reassessment of our recommendations.

We trust that this report meets with your present requirements. Please do not hesitate to contact us should any questions arise.

FIGURES

Site Location Plan	Figure 1
Borehole Location Plan	**Figure 2**
Grain Size Analysis	**Figure 3**, 4, 5, and 6

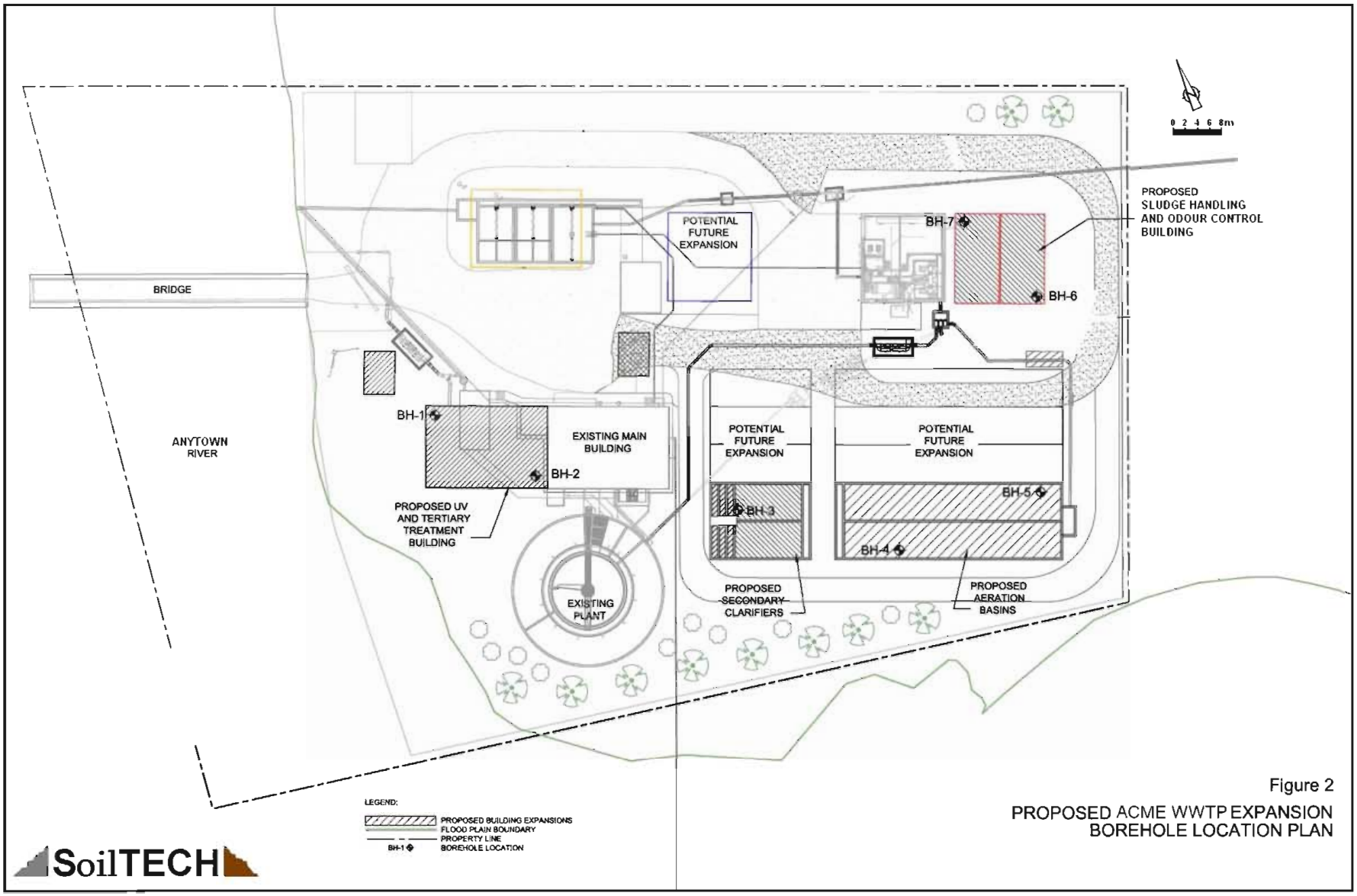


Figure 2

PROPOSED ACME WWTP EXPANSION
BOREHOLE LOCATION PLAN

SoilTECH

SoilTECH

HYDROMETER ANALYSIS
ASTM D422

PROJECT:	ACME WWTP Expansion	SAMPLE DATE:	June 3, 2008
LOCATION:	City of Anytown	SAMPLE NO.:	BH-1, SS6
CLIENT:	Consulting Ltd./City of Anytown	SAMPLE DEPTH:	4.5 m – 5.2 m
SOIL DESCRIPTION:	Clayey silt, some sand		
SOIL COMPOSITION:	Clay 21%, Silt 67%, Sand 12%		

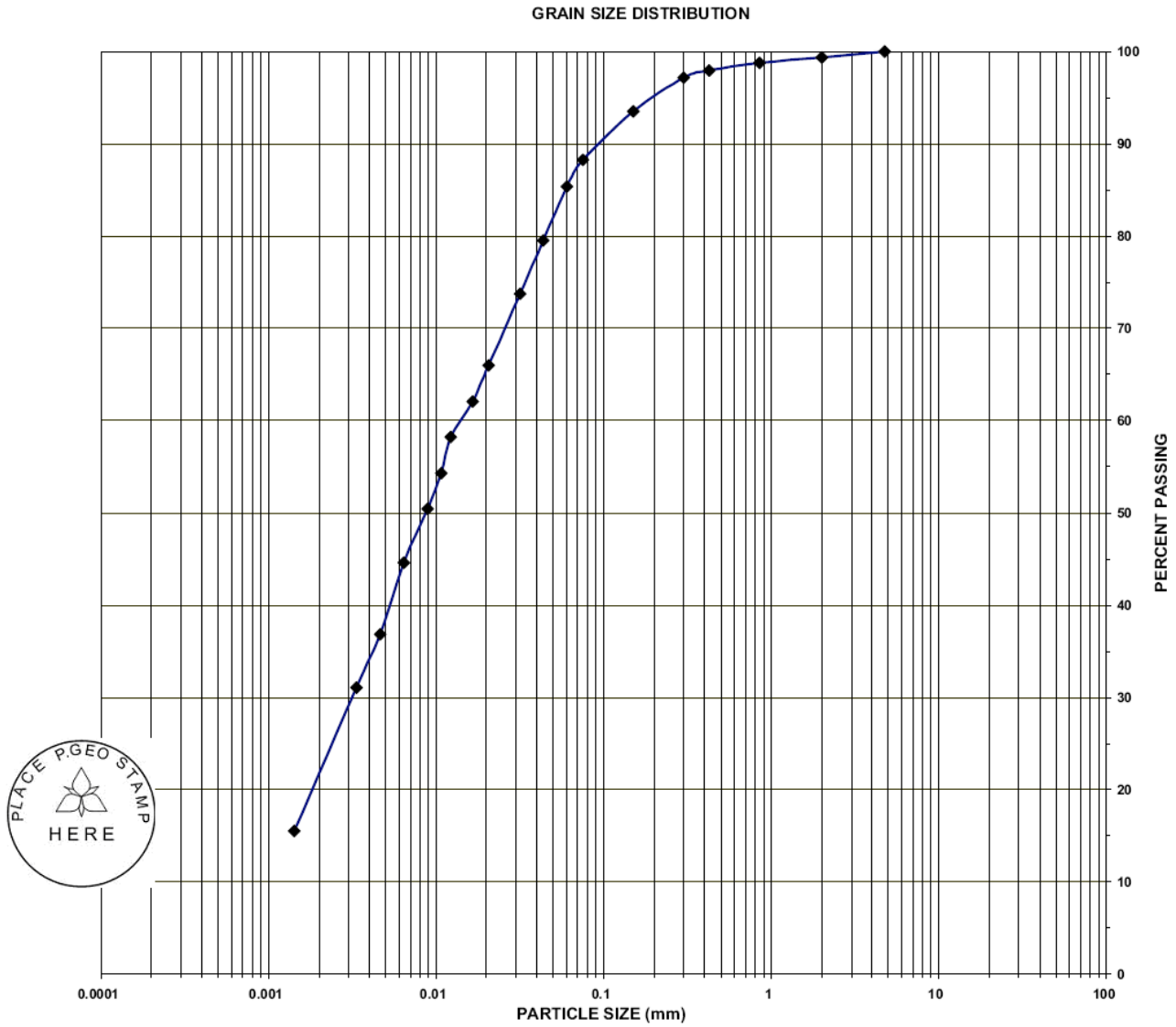


Figure 3
Grain Size Analysis – BH-1

SoilTECH

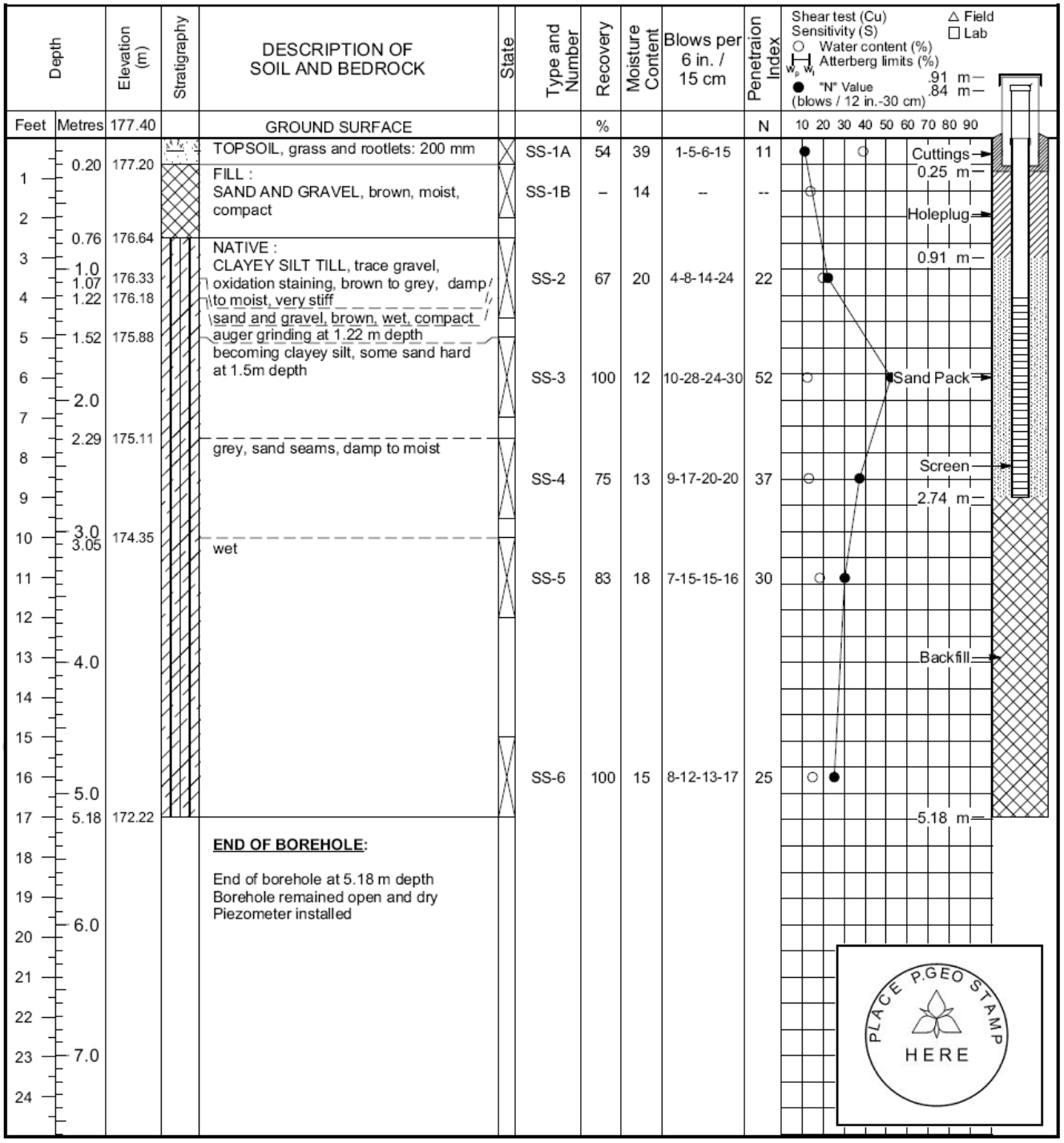
APPENDIX A

Boreholes Logs **Enclosure 1**, 2, 3, 4, 5, 6, and 7

SoilTECH

BOREHOLE REPORT

PROJECT:	ACME WWTP Expansion	BOREHOLE NO.:	BH-1
LOCATION:	City of Anytown	ELEVATION:	177.40 m
CLIENT:	Consulting Ltd./City of Anytown		
DESCRIBED BY:	A. Tech	START DATE:	June 3, 2008
CHECKED BY:	B. Tech	END DATE:	June 3, 2008



APPENDIX H

ODOUR EMISSION MODELLING OUTPUT

ATTACHMENT 10

ENGINEERING DESIGN DRAWINGS AND SPECIFICATIONS

ENGINEERING DESIGN DRAWINGS

NOTE: Please print drawings on 11x17 paper for adequate legibility.

KEY MAP

LOCATION PLAN

ACME WASTEWATER TREATMENT PLANT

EXPANSION

CITY OF ANYTOWN
AUGUST 2009

City of Anytown
ACME Wastewater Treatment Plant

CONSULTING LTD.

DRAWING INDEX

SHEET No	DRAWING NUMBER	DESCRIPTION
		GENERAL
1	G-01	COVER SHEET
2	G-02	DRAWING INDEX
3	G-03	GENERAL ABBREVIATIONS
		CIVIL
4	C-01	CIVIL LEGEND SHEET
5	C-02	EXISTING SITE FACILITY AND DEMOLITION PLAN
6	C-03	PROPOSED SITE FACILITY AND PIPING PLAN
7	C-04	GRADING AND DRAINAGE PLAN
8	C-05	GRADING AND DRAINAGE PLAN - SECTIONS AND DETAILS (1 OF 2)
9	C-06	GRADING AND DRAINAGE PLAN - SECTIONS AND DETAILS (2 OF 2)
10	C-07	EROSION AND SEDIMENT CONTROL PLAN
11	C-08	EROSION AND SEDIMENT CONTROL PLAN DETAILS
12	C-09	600mm OUTFALL PIPE - PLAN AND PROFILE
13	C-10	400mm TEMPORARY CONSTRUCTION CONNECTION PIPE - PLAN AND PROFILE
14	C-11	600mm SECONDARY EFFLUENT PIPES - PLAN AND PROFILE
15	C-12	400mm SECONDARY INFLUENT PIPE - PLAN AND PROFILE
16	C-13	CIVIL TYPICAL DETAILS, SHEET 1 OF 3
17	C-14	CIVIL TYPICAL DETAILS, SHEET 2 OF 3
18	C-15	CIVIL TYPICAL DETAILS, SHEET 3 OF 3
19	C-16	SECONDARY TREATMENT HYDRAULIC PROFILE, SHEET 1 OF 3
20	C-17	TERTIARY TREATMENT HYDRAULIC PROFILE, SHEET 2 OF 3
21	C-18	OUTFALL HYDRAULIC PROFILE, SHEET 3 OF 3
		LANDSCAPE
22	L-01	LANDSCAPE PLAN
		ARCHITECTURAL
23	A-01	SLUDGE HANDLING BUILDING - ARCHITECTURAL NOTES AND SCHEDULES
24	A-02	SLUDGE HANDLING BUILDING - UPPER FLOOR PLANS
25	A-03	SLUDGE HANDLING BUILDING - LOWER FLOOR PLAN
26	A-04	SLUDGE HANDLING BUILDING - ROOF FRAMING PLAN
27	A-05	SLUDGE HANDLING BUILDING - BUILDING SECTION - A
28	A-06	SLUDGE HANDLING BUILDING - BUILDING SECTION - B
29	A-07	SLUDGE HANDLING BUILDING - BUILDING SECTION - C
30	A-08	SLUDGE HANDLING BUILDING - BUILDING SECTION - D
31	A-09	SLUDGE HANDLING BUILDING - SOUTH ELEVATION
32	A-10	SLUDGE HANDLING BUILDING - EAST AND WEST ELEVATIONS
33	A-11	SLUDGE HANDLING BUILDING - NORTH ELEVATION
34	A-12	SLUDGE HANDLING BUILDING - DETAILS
35	A-13	TERTIARY TREATMENT BUILDING - ARCHITECTURAL NOTES AND SCHEDULES
36	A-14	TERTIARY TREATMENT BUILDING - UPPER FLOOR PLAN
37	A-15	TERTIARY TREATMENT BUILDING - LOWER FLOOR PLAN
38	A-16	TERTIARY TREATMENT BUILDING - BUILDING SECTION - A
39	A-17	TERTIARY TREATMENT BUILDING - BUILDING SECTION - B
40	A-18	TERTIARY TREATMENT BUILDING - BUILDING SECTION - C
41	A-19	TERTIARY TREATMENT BUILDING - BUILDING SECTION - D
42	A-20	TERTIARY TREATMENT BUILDING - BUILDING SECTION - E
43	A-21	TERTIARY TREATMENT BUILDING - BUILDING SECTION - F
44	A-22	TERTIARY TREATMENT BUILDING - NORTH AND SOUTH ELEVATIONS
45	A-23	TERTIARY TREATMENT BUILDING - EAST AND WEST ELEVATIONS
46	A-24	TERTIARY TREATMENT BUILDING - DETAILS
47	A-25	RAS-WAS BUILDING - ARCHITECTURAL NOTES AND SCHEDULES
48	A-26	RAS-WAS BUILDING - UPPER AND LOWER FLOOR PLANS
49	A-27	RAS-WAS BUILDING - BUILDING SECTIONS
50	A-28	RAS-WAS BUILDING - ELEVATIONS
51	A-29	RAS-WAS BUILDING - DETAILS
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SHEET No	DRAWING NUMBER	DESCRIPTION
		STRUCTURAL (CONTINUED)
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63	S-08	TERTIARY TREATMENT BUILDING - UPPER FLOOR FDN PLAN
64	S-09	TERTIARY TREATMENT BUILDING - STRUCTURAL FLOOR PLAN
65	S-10	TERTIARY TREATMENT BUILDING - BUILDING SECTION
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68	S-13	TERTIARY TREATMENT BUILDING - BUILDING SECTION
69	S-14	TERTIARY TREATMENT BUILDING - BUILDING SECTION
70	S-15	TERTIARY TREATMENT BUILDING - BUILDING SECTION
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86	M-03	NEW TERTIARY TREATMENT PROCESS FLOW DIAGRAM, SHEET 2 OF 5
87	M-04	UV TREATMENT AND PROCESS PLANT WATER SYSTEM PROCESS FLOW DIAGRAM, SHEET 3 OF 5
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92	M-09	SLUDGE HANDLING BUILDING HVAC PLANS
93	M-10	SLUDGE HANDLING BUILDING SECTION
94	M-11	TERTIARY TREATMENT/UV BUILDING UPPER FLOOR PLAN
95	M-12	TERTIARY TREATMENT/UV BUILDING LOWER FLOOR PLAN
96	M-13	TERTIARY TREATMENT/UV BUILDING HVAC PLAN
97	M-14	TERTIARY TREATMENT/UV BUILDING SECTIONS, SHEET 1 OF 3
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99	M-16	TERTIARY TREATMENT/UV BUILDING SECTIONS, SHEET 3 OF 3
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		INSTRUMENTATION & CONTROL
115	IC-00	P&ID OVERVIEW BLOCK DIAGRAM
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118	IC-03	P&ID LEGEND, SHEET 3 OF 3
119	IC-04	NEW PLANT AERATION SYSTEM P&ID
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SHEET No	DRAWING NUMBER	DESCRIPTION
		INSTRUMENTATION & CONTROL (CONTINUED)
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122	IC-07	UV SYSTEM AND FINAL EFFLUENT P&ID
123	IC-08	LAMELLA CLARIFIER AND REJECT SUMP P&ID
124	IC-09	SLUDGE HANDLING P&ID
125	IC-10	SCUM SYSTEM AND LOADING STATION P&ID
126	IC-11	ALUM CHEMICAL FEED P&ID
127	IC-12	POLYMER CHEMICAL FEED P&ID
128	IC-13	AERATION BLOWERS P&ID
129	IC-14	HEADWORKS MODIFICATION P&ID
130	IC-15	BUILDING SYSTEMS P&ID
131	IC-16	DIESEL GENERATOR P&ID
132	IC-17	ODOUR CONTROL SYSTEM P&ID
		ELECTRICAL
133	E-01	ELECTRICAL LEGEND
134	E-02	ELECTRICAL SITE PLAN
135	E-03	NEW MAIN ENTRANCE SWITCHBOARD SINGLE LINE DIAGRAM
136	E-04	NEW SLUDGE HANDLING BUILDING MCC-D SINGLE LINE DIAGRAM
137	E-05	NEW SLUDGE HANDLING BUILDING MCC-D LAYOUT AND LP SCHEDULES
138	E-06	NEW TERTIARY BUILDING MCC-C SINGLE LINE DIAGRAM
139	E-07	NEW TERTIARY BUILDING MCC-C LAYOUT AND LP SCHEDULES
140	E-08	NEW RAS/WAS BUILDING MCC-E SINGLE LINE DIAGRAM
141	E-09	NEW RAS/WAS BUILDING MCC-E LAYOUT AND LP SCHEDULES
142	E-10	PROPOSED MODIFICATIONS TO EXISTING MCC-A SINGLE LINE DIAGRAM
143	E-11	PROPOSED MODIFICATIONS TO EXISTING MCC-A LAYOUT AND LP SCHEDULES
144	E-12	MOTOR CONTROL SCHEMATICS 1 OF 5
145	E-13	MOTOR CONTROL SCHEMATICS 2 OF 5
146	E-14	MOTOR CONTROL SCHEMATICS 3 OF 5
147	E-15	MOTOR CONTROL SCHEMATICS 4 OF 5
148	E-16	MOTOR CONTROL SCHEMATICS 5 OF 5
149	E-17	CONTROL SCHEMATICS 1 OF 5
150	E-18	CONTROL SCHEMATICS 2 OF 5
151	E-19	CONTROL SCHEMATICS 3 OF 5
152	E-20	CONTROL SCHEMATICS 4 OF 5
153	E-21	CONTROL SCHEMATICS 5 OF 5
154	E-22	SLUDGE HANDLING BUILDING SERVICES PLAN
155	E-23	SLUDGE HANDLING BUILDING POWER AND INSTRUMENTATION PLAN
156	E-24	SLUDGE HANDLING BUILDING CABLE TRAY PLAN
157	E-25	TERTIARY BUILDING UPPER FLOOR SERVICES PLAN
158	E-26	TERTIARY BUILDING LOWER FLOOR SERVICES PLAN
159	E-27	TERTIARY BUILDING UPPER FLOOR POWER AND INSTRUMENTATION PLAN
160	E-28	TERTIARY BUILDING LOWER FLOOR POWER AND INSTRUMENTATION PLAN
161	E-29	TERTIARY BUILDING CABLE TRAY PLAN
162	E-30	RAS/WAS BUILDING SERVICES PLAN
163	E-31	RAS/WAS BUILDING POWER AND INSTRUMENTATION PLAN
164	E-32	RAS/WAS BUILDING CABLE TRAY PLAN
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167	E-35	TYPICAL CONTROL PANEL AND UPS CABINET DETAILS
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ISSUED FOR MOE APPROVAL

SCALE VERIFICATION: THIS BAR MEASURES 50mm ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

No	Revision	Date	Initial

Approval

PLACE RUNNING STAMP HERE

City of Anytown

ACME WWTP EXPANSION

DRAWING INDEX

CONSULTING LTD.

Project Manager	Reviewed By	Designed By	Drawn By
AB	DD	EF	GH
Scale: NTS	Project No: 53469-02	Phase No: 010	Drawing No: G-02

ABV	ABOVE
ACC	ACCESS
ACCESS	ACCESSORY
ACT	ACTUATOR
ADD	ADDITION
ADJ	ADJUSTABLE
AFF	AFFECTED
AGG	AGGREGATE
AHU	AIR HANDLING UNIT
AL	ALUMINUM
ALT	ALTERNATE
ANC	ANCHOR
ANN	ANNUNCIATOR
APPROX	APPROXIMATELY
APT	APARTMENT
ARCH	ARCHITECT
ASPH	ASPHALT
ASSY	ASSEMBLY
ATC	AUTOMATIC TEMPERATURE CONTROL
ATS	AUTOMATIC TRANSFER SWITCH
AUTO	AUTOMATIC
AVG	AVERAGE
AWG	AMERICAN WIRE GAUGE
BAL	BALANCE
BC	BOTTOM OF CRUSH
BD	BOARD
BEV	BEVEL
BF	BOTTOM OF FOUNDATION
BFV	BUTTERFLY VALVE
BKF	BACKFLOW PREVENTER
BLDG	BUILDING
BLK	BLOCK
BLKG	BLOCKING
BLW	BELOW
BM	BEAM
BOC	BOTTOM OF CURB
BOP	BOTTOM OF PIPE
BOT	BOTTOM
BP	BASE PLATE
BR	BEARING
BRG	BEARING
BRKT	BRACKET
BSMT	BASEMENT
BTW	BETWEEN
BV	BALL VALVE
BW	BOTH WAYS
CA	CANOPY
CBS	CONCRETE BLOCK
CEM	CEMENT
CFM	CUBIC FEET PER MINUTE
CHK	CHECK
CHP	CHAMFER, FIRE PUMP
CIP	CAST IN PLACE
CJ	CONTROL JOINT
CLEG	CLEANING
CLR	CLEAR
CMU	CONCRETE MASONRY UNIT
CO	CLEANOUT
COL	COLUMN
CONC	CONCRETE
CONN	CONNECTION
CONST	CONSTRUCTION
CONT	CONTINUOUS
COORD	COORDINATE
CP	CONTROL POINT
CPLG	COUPLING
CPT	CARPET
CR	CRANE
CRS	CROSS
CSK	COUNTERSINK
CT	CENTER
CTR	CENTER
CTRD	CENTERED
CTRL	CONTROL
CTS	CONTROL TOWER SYSTEM
CU	CUBIC
CUH	CABINET UNIT HEATER
CV	CHECK VALVE
CW	CURTAIN WALL
DA	DRY AIR
DBL	DOUBLE
DEC	DECORATIVE
DEG	DEGREE
DEMO	DEMOLISH
DET	DETAIL
DF	DRINKING FOUNTAIN
DFU	DRAINAGE FIXTURE UNIT
DIA	DIAMETER
DIAG	DIAGONAL
DIM	DIMENSION
DISP	DISPENSER
DIV	DIVISION
DL	DEAD LOAD
DLL	DUCT LINER INSULATION
DN	DOWN
DOA	DRY OPPOSED ACTION
DPDT	DOUBLE POLE DOUBLE THROW
DPST	DOUBLE POLE SINGLE THROW
DR	DOOR
DRWG	DRAWING
DS	DOWN SPOUT
DT	DUCT TAPE
DWG	DRAWING
DWR	DRAWER
EA	EACH
EAC	EACH WAY
EB	EXPANSION BOLT
EC	ELECTRICAL CONTRACTOR
EL	ELEVATION
ELEC	ELECTRIC
ELEV	ELEVATOR
EMER	EMERGENCY
ENCL	ENCLOSURE
ENGR	ENGINEER
EP	EDGE OF PAVEMENT
EQ	EQUAL
EQUIP	EQUIPMENT
ERW	ELECTRIC RESISTANCE WELDED
ES	EACH SIDE
EST	ESTIMATE
ETR	EXTERIOR
EW	EACH WAY
EWC	ELECTRIC WATER COOLER
EXC	EXCAVATE
EXH	EXHAUST
EXP	EXPANSION
EXT	EXTERIOR
FAB	FABRICATE
FAC	FACE
FBO	FURNISHED BY OTHERS
FCO	FLOOR CLEANOUT
FD	FLOOR DRAIN
FDC	FIRE DEPARTMENT CONNECTION
FE	FIRE EXTINGUISHER
FEC	FIRE EXTINGUISHER CABINET
FF	FINISH FLOOR
FFE	FINISH FLOOR ELEVATION
FG	FINISH GRADE
FH	FIRE HOSE
FHC	FIRE HOSE CABINET
FHR	FIRE HOSE REEL
FIN	FINISH
FL	FLOW LINE
FLEX	FLEXIBLE
FLG	FLANGE
FLR	FLOOR
FLUOR	FLUORESCENT
FM	FACTORY MUTUAL
FOC	FACE OF CONCRETE
FOF	FACE OF FINISH
FOM	FACE OF MASONRY
FOS	FACE OF STUD
FOW	FACE OF WALL
FP	FIRE PUMP
FPM	FEET PER MINUTE
FPS	FEET PER SECOND
FPT	FEMALE PIPE THREAD
FR	FRAME
FRP	FIBERGLASS REINFORCED PLASTIC
FS	FULL SIZE
FSC	FINISH SURFACE CONDITION
FT	FOOT
FTG	FOOTING
FURN	FURNISH
FUT	FUTURE
GA	GAUGE
GAL	GALVANIZED
GALV	GALVANIZED
GB	GRADE BEAM
GC	GENERAL CONTRACTOR
GEN	GENERATOR
GFCI	GROUND FAULT CIRCUIT INTERRUPTER
GI	GALVANIZED IRON
GL	GLASS
GLB	GLUED LAMINATED BEAM
GLZ	GLAZING
GND	GROUND
GPD	GALLONS PER DAY
GPH	GALLONS PER HOUR
GPM	GALLONS PER MINUTE
GPS	GALLONS PER SECOND
GR	GRADE (GARDEN)
GRAD	GRADE, GRADING
GRD	GROUND
GSM	GALVANIZED SHEET METAL
GT	GUTTER
GTD	GALVANIZED TIE DOWN
GV	GATE VALVE
GWB	GYPSUM WALL BOARD
HB	HOSE BIBB
HC	HOLLOW CORE
HD	HEAD
HDG	HOT DIPPED GALVANIZED
HDPE	HIGH DENSITY POLYETHYLENE
HDR	HEADER
HDWD	HARDWOOD
HDWE	HARDWARE
HEX	HEXAGON
HGT	HEIGHT
HM	HOLLOW METAL
HOR	HORIZONTAL
HORIZ	HORIZONTAL
HP	HORSEPOWER
HPC	HIGH PERFORMANCE CONCRETE
HPT	HIGH POINT
HR	HOUR
HSS	HIGH STRENGTH STEEL
HT	HEIGHT
HTG	HEATING
HTR	HEATER
HVAC	HEATING, VENTILATION, AIR CONDITIONING
HW	HOT WATER
HWH	HOT WATER HEATER
HWR	HOT WATER RECIRCULATING PUMP
HWS	HOT WATER SUPPLY
HWSW	HOT WATER SWITCH
HYD	HYDRANT
HYDR	HYDRAULIC
HYGR	HYGROMETER
HZ	HERTZ
ID	INSIDE DIAMETER
IF	INSIDE FACE
IN	INCH
INSTR	INSTRUCTION
I.U.L.M.	ILLUMINATION
IW	INSIDE WIDTH (CLEAR)
IWS	INSPECTOR
JB	JUNCTION BOX
JC	JANITOR CLOSET
JH	JUNCTION BOX
JST	JOIST
KD	KNOCKED DOWN
KEF	KIPS PER SQUARE FOOT
KIP	KIPS PER SQUARE INCH
KW	KILOWATT
KWH	KILOWATT HOUR
KWHR	KILOWATT HOURMETER
KWR	KILOWATT WATTMETER
LAB	LABORATORY
LAM	LAMINATE
LAV	LAVATORY
LB	POUND
LBL	LABEL
LDG	LANDING
LDR	LEADER
LEED®	LEED GENERATE FOR THE ENVIRONMENT
LG	LONG
LH	LEFT HAND
LHR	LEFT HAND REVERSE
LIN	LINEAR
LKR	LOCKER
LL	LIVE LOAD
LLH	LONG LEG HORIZONTAL
LLV	LONG LEG VERTICAL
LNTL	LINTEL
LO	LOCATION NOT CL
LOC	LOCATION
LOUV	LOUVRE, LOUVER
LP	LIGHT POLE
LR	LIVE REINFORCE
LV	LOW VOLT
LVR	LEVELING RISER
LWR	LEVELING RISER REVERSE
LWS	LOWER
LT	LIGHT
LTG	LIGHTING
LTG FIX.	LIGHTING FIXTURE
LV	LOW VOLTAGE
MA	MAINTENANCE
MAR	MARBLE
MAS	MASONRY
MAT	MATERIAL
MAX	MAXIMUM
MB	MACHINE BOLT
MC	MEDICINE CABINET
MCC	MOTOR CONTROL CENTER
MDF	MEDIUM DENSITY FIBERBOARD
MECH	MECHANICAL
MEMB	MEMBRANE
MET	METAL
MEZZ	MEZZANINE
MFR	MANUFACTURER
MH	MANHOLE
MIC	MICROPHONE
MIN	MINIMUM
MIR	MIRROR
MISC	MISCELLANEOUS
MJ	MASONRY JOINT
MO	MASONRY OPENING
MOD	MODULE
MOT	MOTOR
MPT	MALE PIPE THREAD
MR	MOISTURE RESISTANT
MTD	MOUNTED
MTG	MOUNTING
MTL	METAL
MTR	MOTOR
MUL	MULLION
NA	NOT APPLICABLE
NC	NORMALLY CLOSED
NEC	NATIONAL ELECTRICAL CODE
NFPA	NATIONAL FIRE PROTECTION ASSOCIATION
NIC	NOT IN CONTRACT
NO	NUMBER
NOM	NOMINAL
NPT	NATIONAL PIPE THREAD
NTS	NOT TO SCALE
NW	NORMAL WEIGHT
OA	OVERALL
OBS	OBSCURE
OC	ON CENTER
OD	OUTSIDE DIAMETER
OF	OUTSIDE FACE
OFCI	OWNER FURNISHED CONTRACTOR INSTALLED
OFOI	OWNER FURNISHED OWNER INSTALLED
OH	OVERHEAD
OPNG	OPENING
OPP	OPPOSITE
OPT	OPTIONAL
ORD	OVERFLOW ROOF DRAIN
OS	OUTSIDE SIZE
OSB	ORIENTED STRAND BOARD
OVFL	OVERFLOW
OZ	OUNCE
PA	PUBLIC ADDRESS
PAR	PARALLEL
PB	PUSH BUTTON
PC	PIECE
PCC	PRECAST CONCRETE
PCF	POUNDS PER CUBIC FOOT
PCS	PIECES
PE	PLAIN END
PERF	PERFORATED
PERP	PERPENDICULAR
PH	PHASE
PIV	POST INDICATOR VALVE
PL	PLATE
PLAM	PLASTIC LAMINATE
PLAS	PLASTER
PLBG	PLUMBING
PLF	POUNDS PER LINEAR FOOT
PLYWD	PLYWOOD
PNL	PANEL
PNT	PAINT
POC	POINT OF CONNECTION
POL	POLISHED
POR	PORCELAIN
PPM	PARTS PER MILLION
PR	PAIR
PRC	POINT OF REVERSE CURVE
PRECT	PRECAST
PRESS	PRESSURE
PRV	PRESSURE REDUCING VALVE
PSF	POUNDS PER SQUARE FOOT
PSI	POUNDS PER SQUARE INCH
PSIG	POUNDS PER SQUARE INCH GAUGE
PT	POINT
PTD	PAINTED
PTN	PARTITION
PVC	POLYVINYL CHLORIDE
PVMT	PAVEMENT
QT	QUARRY TILE
QTY	QUANTITY
R	RISER
RAD	RADIUS
RB	RUBBER
RCP	REINFORCED CONCRETE PIPE
RD	ROOF DRAIN
REC	RECEPTACLE
REF	REFRIGERATOR
REFL	REFLECTED
REINF	REINFORCED
REQ	REQUIRED
RES	RESILIENT
RET	RETAIN
REV	REVISION
RF	RADIO FREQUENCY
RFG	ROOFING
RFP	REQUEST FOR PROPOSAL
RH	RIGHT HAND
RHR	RIGHT HAND REVERSE
RM	ROOM
RO	ROUGH OPENING
RPM	REVOLUTIONS PER MINUTE
RR	RAIN RECEIVER
RT	RIGHT
RTU	ROOF TOP UNIT
RVS	REVERSE
RW	RETAINING WALL
S	SOUTH
SA	SUPPLY AIR
SAN	SANITARY
SAT	SATELLITE
SC	SOLID CORE
SCHED	SCHEDULE
SD	SOAP DISPENSER
SDR	STANDARD DIMENSION RATIO
SEC	SECTION
SECT	SECTION
SF	SQUARE FOOT
SFRM	SPRAY FIRE RESISTANT MATERIAL
SG	SAGE GREEN
SGL	SINGLE
SHT	SHEET
SHTG	SHEATHING
SIM	SIMILAR
SL	SLOPE
SLD	SOLID
SLDR	SOLDER
SLV	SLEEVE
SM	SHEET METAL
SMD	SMOOTH
SMTH	SMOOTH
SN	SNOW
SNR	SENIOR
SOG	SLAB ON GRADE
SP	SPACE
SPA	SPACES
SPEC	SPECIFICATION
SPKR	SPEAKER
SPRK	SPRINKLER
SQ	SQUARE
SQ FT	SQUARE FOOT
SQ IN	SQUARE INCH
SQ YD	SQUARE YARD
SS	STAINLESS STEEL
SSD	SEE STRUCTURAL DRAWINGS
SSK	SEE STRUCTURAL KEYNOTES
SST	STAINLESS STEEL
STA	STATION
STD	STANDARD
STIFF	STIFFENER
STL	STEEL
STOR	STORAGE
STR	STRUCTURAL
STRUCT	STRUCTURE
SUSP	SUSPENDED
SV	SHEET VINYL
SW	SHEAR WALL
SYM	SYMMETRICAL
SYP	SOUTHERN YELLOW PINE
T	TOP
TB	TOWEL BAR
TBD	TO BE DETERMINED
TBM	TEMPORARY BENCH MARK
TC	TOP OF CONCRETE
TCD	TOP OF CURB DRAIN
TD	TOP OF DRAIN
TDH	TOTAL DYNAMIC HEAD
TE	TOP OF ELEVATOR
TEL	TELEPHONE
TEMP	TEMPORARY
TER	TERRAZZO
TF	TOP OF FOOTING
TFL	TOP OF FINISHED FLOOR
THD	THREADED
THK	THICK
THRES	THRESHOLD
TJ	TOOLED JOINT
TL	TOP OF LEDGE
TLT	TOILET
TM	TOP OF MASONRY
TOC	TOP OF CONCRETE
TOP	TOP OF PARAPET
TOS	TOP OF STEEL
TOW	TOP OF WALL
TP	TOILET PAPER
TPD	TOILET PAPER DISPENSER
TPH	TOILET PAPER HOLDER
TR	TREAD
TRANS	TRANSFORMER
TRD	TREAD
TS	TUBE STEEL
TSD	TOP OF SHELL
TYP	TYPICAL
UC	UNDERCUT
UCP	UNDERCUT PAD
UD	UNDERDRAIN
UFC	UNIFORM FIRE CODE
UG	UNDERGROUND
UH	UNIT HEATER
UL	UNDERWRITERS LABORATORIES
UNFIN	UNFINISHED
UNO	UNLESS NOTED OTHERWISE
UON	UNLESS OTHERWISE NOTED
UR	URINAL
UTIL	UTILITY
UV	ULTRAVIOLET
V	VENT
VAC	VACUUM
VAV	VOLUME AIR VARIABLE
VB	VAPOR BARRIER
VCT	VINYL COMPOSITION TILE
VERT	VERTICAL
VEST	VESTIBULE
VIF	VERIFY IN FIELD
VOL	VOLUME
W	WIDE, WIDTH, WATER
W/	WITH
W/O	WITHOUT
WC	WATER CLOSET
WD	WOOD
WDW	WINDOW
WH	WATER HEATER
WHP	WORKING PRESSURE
WI	WROUGHT IRON
WIN	WINDOW
WM	WATER METER
WP	WATERPROOF
WPT	WORK POINT
WR	WATER RESISTANT
WRT	WITH RESPECT TO
WSCT	WAINSCOT
WT	WEIGHT
WWF	WELDED WIRE FABRIC
XFMR	TRANSFORMER
XH	EXTRA HEAVY
XS	EXTRA STRONG
YD	YARD
YH	YARD HYDRANT

NOTES:

1. THIS IS A STANDARD LISTING LIST, THEREFORE SOME ITEMS OR ABBREVIATIONS MAY APPEAR ON THIS LIST AND NOT ON THE DRAWINGS.
2. CONTACT ENGINEER FOR ABBREVIATIONS NOT LISTED.

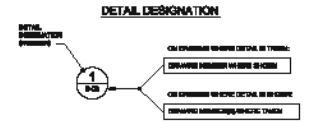
STANDARD DETAIL DESIGNATION



SECTION DESIGNATION



DETAIL DESIGNATION



ISSUED FOR MOE APPROVAL

SCALE VERIFICATION: THIS BAR, MEASURED 40mm ON ORIGINAL, ADJUST SCALE ACCORDINGLY

No	Revision	Date	Initial

Approval

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City of Anytown

ACME WWTP EXPANSION

GENERAL ABBREVIATIONS

CONSULTING LTD.

Client Reference			Date: AUG 2025
Project Manager: AS	Reviewed By: DD	Designed By: EF	Drawn By: BH
Status: MOE	Project No: 53469-02	Phase: 010	Drawing No: G-03

CIVIL LEGEND

MUNICIPAL SYMBOLS EXISTING

- PROPERTY BOUNDARY
- FLOOD PLAIN LINE
- FENCE
- DITCH, SWALE
- GROUND CONTOUR
- GROUNDWATER ELEVATION CONTOUR (PIEZOMETRIC OR POTENTIOMETRIC SURFACE)
- BOE EXCAVATION CONTOUR
- FINAL CONTOUR
- LIMIT OF REFUSE DISPOSAL
- SLOPED SURFACE (TOP OF BANK)
- BUILDING
- RAILWAY
- SHORELINE
- ACCESS ROAD
- WATERMAIN
- SANITARY SEWER
- STORM SEWER
- GAS MAIN
- TELEPHONE LINE
- ELECTRIC CABLE
- OVERHEAD CABLE, WIRE
- EXISTING SPOT ELEVATION

- STANDARD IRON BAR
- IRON BAR
- ROUND IRON BAR
- MONUMENT/BENCHMARK
- CUT CROSS
- IRON PIPE
- NAIL/CONTROL
- STORM MANHOLE
- CATCHBASIN
- DOUBLE CATCHBASIN
- WATER VALVE
- VALVE CHAMBER
- CURB STOP
- HYDRANT
- DITCH INLET CATCHBASIN
- ROAD SIGN
- UTILITY POLE
- GUY ANCHOR
- GAS VALVE
- TELEPHONE PEDESTAL
- TELEPHONE CHAMBER
- HAND WELL
- ELECTRICAL MANHOLE
- LIGHT STANDARD
- DECIDUOUS TREE AND DIAMETER
- CONIFEROUS TREE AND DIAMETER
- SHRUB AND DIAMETER
- TREE STUMP AND DIAMETER
- DECIDUOUS CLUMP TREES AND DIAMETER
- CONIFEROUS CLUMP TREES NUMBER AND DIAMETER

REMOVALS

- REMOVALS

MUNICIPAL SYMBOLS PROPOSED

- PROPOSED SANITARY/STORM MANHOLE
- PROPOSED CATCHBASIN
- PROPOSED PERFORATED PIPE (PLAN)
- PROPOSED PERFORATED PIPE (PROFILE)
- PROPOSED SPOT ELEVATION
- PROPOSED CHAINLINK FENCE
- PROPOSED WOODEN FENCE
- PROPOSED SWALE
- PROPOSED OVERHEAD CABLE, WIRE
- PROPOSED BURIED PIPE UTILITY
- PROPOSED STORM WATER PIPE/CULVERT
- PROPOSED 100-YEAR STORMWATER PONDING ELEVATION
- PROPOSED SHEET PILE
- PROPOSED CLAY GROUNDWATER CONTROL BARRIER
- PROPOSED TREE PROTECTION FENCING
- PROPOSED TEMPORARY SILT FENCE
- PROPOSED ROCK CHECK DAM
- PROPOSED COIR LOG CHECK DAM

- PROPOSED VALVE CHAMBER
- PROPOSED HYDRANT
- PROPOSED DOUBLE CATCHBASIN
- PROPOSED UTILITY POLE
- PROPOSED WATER VALVE
- PROPOSED BOLLARD
- PROPOSED ASPHALT
- PROPOSED RIPRAP
- PROPOSED CONCRETE
- PROPOSED CLAY
- PROPOSED GRAVEL
- PROPOSED TURF/TOPSOIL
- PROPOSED PLANTING TYPE 1
- PROPOSED PLANTING TYPE 2
- PROPOSED TREE - EWC

ISSUED FOR MOE APPROVAL

SCALE VERIFICATION: THIS BAR MEASURES 50mm ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

No.	Revision	Date	Initial

Approval

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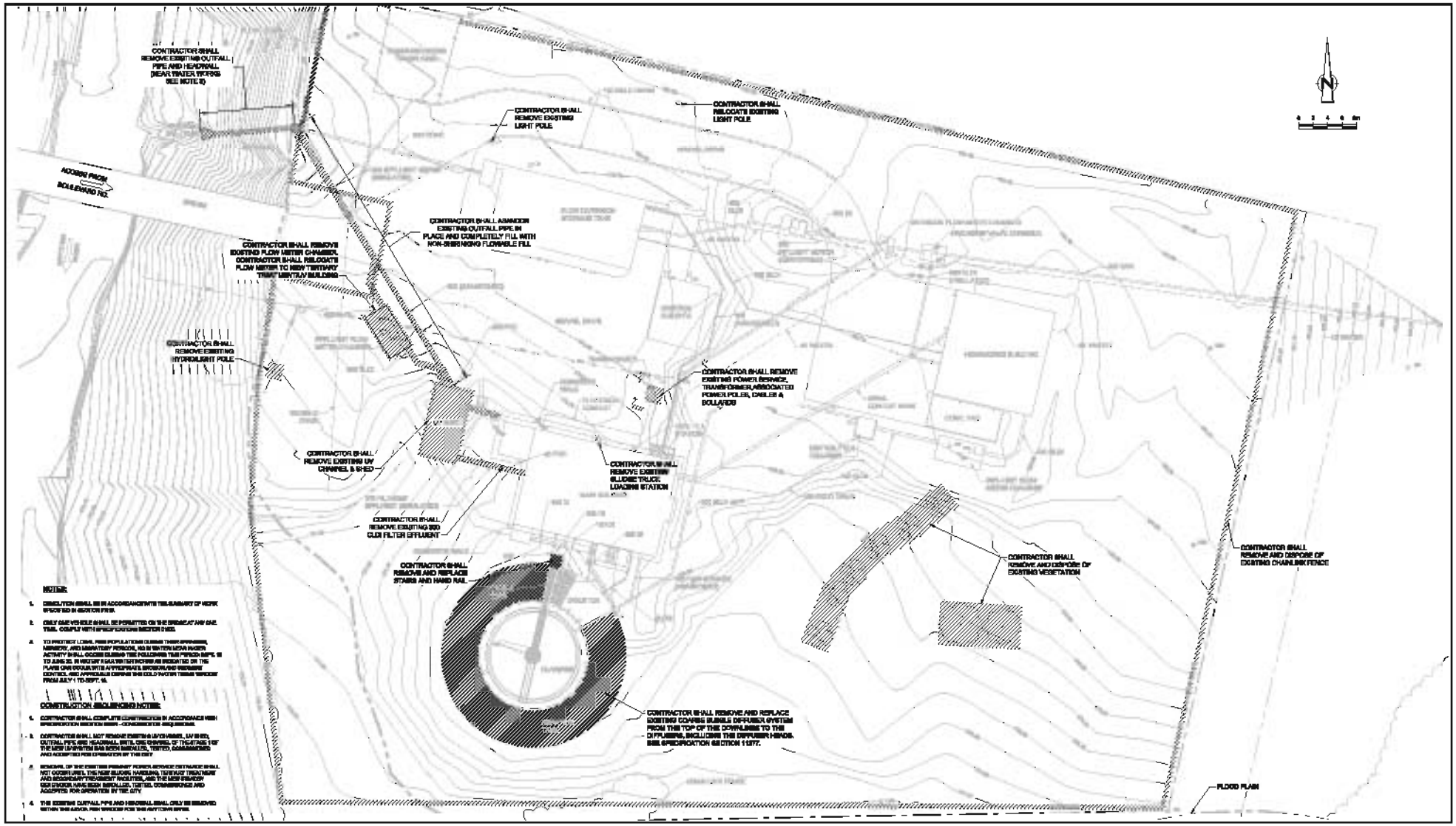
City of Anytown

ACME WWTP EXPANSION

CIVIL LEGEND

Consulting Ltd.

Client Reference			Date: AUG 2025
Project Manager: AB	Reviewed By: DD	Designed By: EF	Drawn By: BH
Scale: NTS	Project No.: 55469-02	Phase: 010	Drawing No.: C-01



ISSUED FOR MOE APPROVAL

SCALE VERIFICATION: THIS BAR SHOULD BE 50mm OR ONE INCH. ADJUST SCALE ACCORDINGLY

No.	Revision	Date	Initial

Approved

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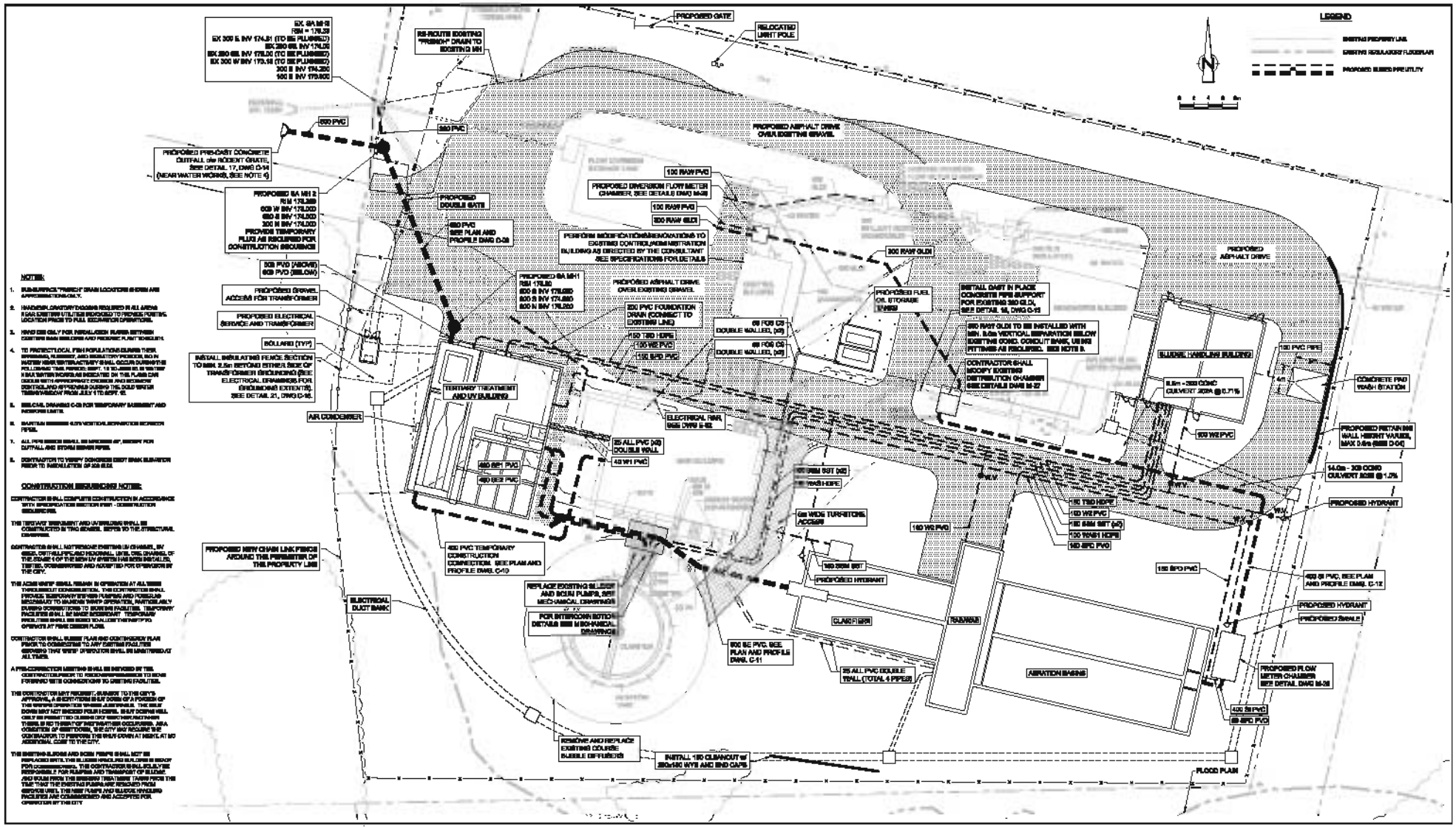
City of Anytown

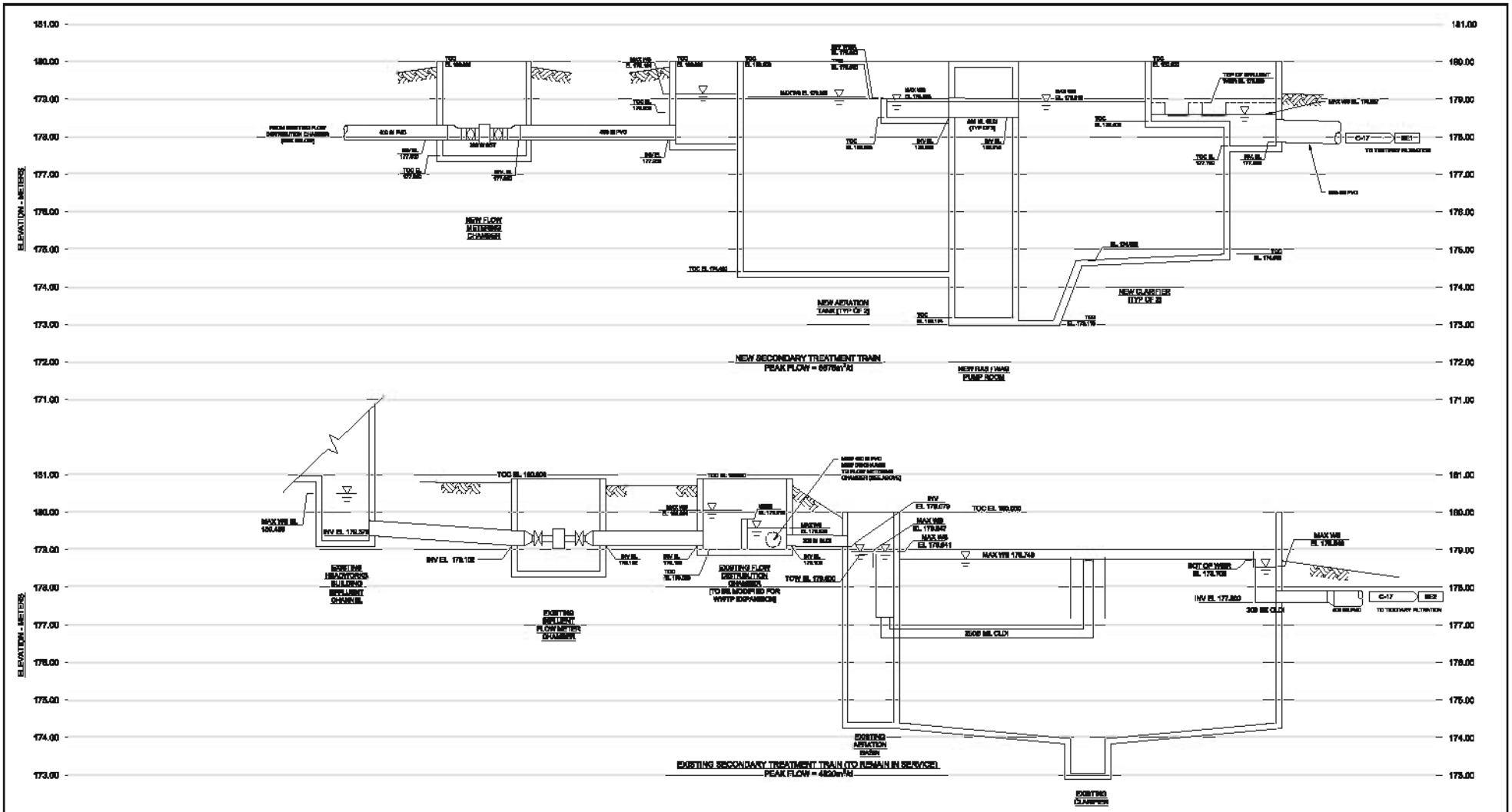
ACME WWTP EXPANSION

EXISTING SITE FACILITY AND DEMOLITION PLAN

CONSULTING LTD.

Drawn	Reviewed	Designed	Date
			AUG 2005
Project Manager: AS	Reviewed By: DO	Designed By: EF	Drawn By: MH
Scale: 1:200	Project No.: 53469-02	Record No.: 010	Drawing No.: C-02


LEGEND
EXISTING PROPERTY LINE
EXISTING REGULATORY FLOODPLAIN
PROPOSED SUBDIVISION PROPERTY
PROPOSED GATE
RELOCATED UNIT POLE
RE-ROUTE EXISTING "FRENCH" DRAIN TO EXISTING MH
EX. SA MH 5
RIM = 176.33
EX 300 S. INV 174.51 (TO BE PLUGGED)
EX 250 SE INV 174.56
EX 250 SE INV 176.00 (TO BE PLUGGED)
EX 300 W INV 175.16 (TO BE PLUGGED)
300 S INV 174.250
100 S INV 179.900
600 PVC
PROPOSED PRE-CAST CONCRETE OUTFALL c/w RODENT GRATE. SEE DETAIL 17, DWG C-14 (NEAR WATER WORKS, SEE NOTE 4)
PROPOSED SA MH 2
RIM 176.300
600 W INV 174.000
600 S INV 174.000
300 N INV 174.000
PROVIDE TEMPORARY PLUG AS REQUIRED FOR CONSTRUCTION SEQUENCE
PROPOSED DOUBLE GATE
450 PVC SEE PLAN AND PROFILE DWG C-10
PROPOSED ASPHALT DRIVE OVER EXISTING GRAVEL
100 RAW PVC
PROPOSED DIVERSION FLOW METER CHAMBER, SEE DETAIL DWG M-08
100 RAW PVC
600 RAW GLDI
PERFORM MODIFICATIONS/RENOVATIONS TO EXISTING CONTROL/ADMINISTRATION BUILDING AS DIRECTED BY THE CONSULTANT SEE SPECIFICATIONS FOR DETAILS
300 RAW GLDI
PROPOSED ASPHALT DRIVE
350 SVR (ABOVE)
600 SVR (BELOW)
PROPOSED GRAVEL ACCESS FOR TRANSFORMER
PROPOSED ELECTRICAL SERVICE AND TRANSFORMER
BOLLARD (TYP.)
INSTALL INSULATING FENCE SECTION TO MIN. 2.5m BEYOND EITHER SIDE OF TRANSFORMER GROUNDING (SEE ELECTRICAL DRAWINGS FOR GROUNDING EXTENTS). SEE DETAIL 21, DWG C-16
PROPOSED SA MH1
RIM 176.00
600 S INV 174.000
600 S INV 174.000
300 N INV 176.200
350 PVC FOUNDATION DRAIN (CONNECT TO EXISTING LINE)
PROPOSED ASPHALT DRIVE OVER EXISTING GRAVEL
PROPOSED FUEL OIL STORAGE TANK
INSTALL CAST IN PLACE CONCRETE PIPE SUPPORT FOR EXISTING 350 GLDI. SEE DETAIL 16, DWG C-13
300 RAW GLDI TO BE INSTALLED WITH MIN. 0.6m VERTICAL SEPARATION BELOW EXISTING CORD. CONDUIT BANK, UNDER FITTINGS AS REQUIRED. SEE NOTE 9.
CONTRACTOR SHALL MODIFY EXISTING DISTRIBUTION CHAMBER SEE DETAILS DWG M-27
BUILDING HANDLING BUILDING
150 PVC PIPE
CONCRETE PAD WASH STATION
6.6m - 300 CONC CULVERT 300A @ 0.71%
PROPOSED RETAINING WALL, HEIGHT VARIES, MAX 0.6m (SEE D-04)
14.0m - 300 CONC CULVERT 300 @ 1.0%
PROPOSED HYDRANT
150 TSD HDPE
150 WE PVC
150 SAN SRT (x2)
100 WASH HDPE
150 SPD PVC
150 SPD PVC
400 SE PVC, SEE PLAN AND PROFILE DWG. C-12
PROPOSED HYDRANT
PROPOSED SWALE
PROPOSED FLOW METER CHAMBER SEE DETAIL DWG M-08
400 SE PVC @ SPD PVC
FLOOD PLAIN
NOTES:
1. SUBSURFACE "FRENCH" DRAIN LOCATIONS SHOWN ARE APPROXIMATIONS ONLY.
2. HANDDIGS/EXCAVATIONS REQUIRED IN ALL AREAS WHERE EXISTING UTILITIES PROPOSED TO PREVENT POSSIBLE DAMAGE FROM MACHINE EXCAVATION OPERATIONS.
3. HAND DIG ONLY FOR INSTALLATION PIPES BETWEEN EXISTING MAIN BUILDING AND PROPOSED PLANT SCHEDULE.
4. TO PROTECT LOCAL FISH POPULATIONS DURING THEIR SPAWNING, REARING, AND MIGRATORY PERIODS, NO IN WATER WORK WITHIN FACTORY SHALL OCCUR DURING THE FOLLOWING TIME PERIOD: SEPT. 15 TO JUNE 30, IN WATER WORK IS INTERPRETED AS ANY WORK ON THE PLANS CAN OCCUR WITH APPROPRIATE CHECKS AND SEDIMENT CONTROL AS APPROVED DURING THE 2010 WATER TIMING WINDOW FROM JULY 15 TO SEPT. 15.
5. SEE CIVIL DRAWING C-09 FOR TEMPORARY EASEMENT AND INTERIM LIMITS.
6. MAINTAIN MINIMUM 0.3% VERTICAL SEPARATION BETWEEN PIPES.
7. ALL PIPE SIZES SHALL BE MINIMUM 20", EXCEPT FOR OUTFALL AND STORM SEWER PIPES.
8. CONTRACTOR TO VERIFY DOWNSTREAM INVERT ELEVATION PRIOR TO INSTALLATION OF 300 SLDI.
CONSTRUCTION SEQUENCING NOTES:
CONTRACTOR SHALL COMPLETE CONSTRUCTION IN ACCORDANCE WITH SPECIFICATION SECTION 01014 - CONSTRUCTION SEQUENCING.
THE TERTIARY TREATMENT AND UV BUILDING SHALL BE CONSTRUCTED IN TWO STAGES. REFER TO THE STRUCTURAL DRAWINGS.
CONTRACTOR SHALL NOTIFY/ENGAGE EXISTING UV CHAMBER, UV SEED, OUTFALL PIPELINE AND PERIPHERAL UNITS. ONE CHANNEL OF THE 2 CHANNEL OF THE NEW UV SYSTEM HAS BEEN INSTALLED, TESTED, COMMISSIONED AND ACCEPTED FOR OPERATION BY THE CITY.
THE ACME WWTP SHALL REMAIN IN OPERATION AT ALL TIMES THROUGHOUT CONSTRUCTION. THE CONTRACTOR SHALL PROVIDE TEMPORARY BYPASS PUMPING AND POSSIBLE SECONDARY TO MAINTAIN WWTP OPERATION, PARTICULARLY DURING CONNECTIONS TO SEWERS FACILITIES. TEMPORARY FACILITIES SHALL BE MADE NECESSARY. TEMPORARY FACILITIES SHALL BE SIZED TO ALLOW THE WWTP TO OPERATE AT PEAK DESIGN FLOW.
CONTRACTOR SHALL SUBMIT PLAN AND CONTINGENCY PLAN PRIOR TO CONNECTION TO ANY EXISTING FACILITIES ENSURING THAT WWTP OPERATION SHALL BE MAINTAINED AT ALL TIMES.
A PRE-CONSTRUCTION MEETING SHALL BE HELD BY THE CONTRACTOR PRIOR TO RECEIVING REVIEWED TO BEING FORWARD WITH CONNECTION TO EXISTING FACILITIES.
THE CONTRACTOR MAY REQUEST, SUBJECT TO THE CITY'S APPROVAL, A SEPTIC TEST IS SUBJECT OF A PERIOD OF THE WWTP OPERATION WHERE ALL TANKS, THE SELF DOWN MAY NOT EXCEED FOUR HOURS. SHUT DOWNS WILL ONLY BE PERMITTED DURING DRY WEATHER (NOT WHEN THERE IS NO TRACE OF PRECIPITATION OCCURRING). ANY CONDITION OF SHUT DOWN, THE CITY MAY REQUIRE THE CONTRACTOR TO PERFORM THE MAIN DOWN AT NIGHT, AT NO ADDITIONAL COST TO THE CITY.
THE EXISTING SLUDGE AND SCUM PIPES SHALL NOT BE REPLACED UNTIL THE SLUDGE HANDLING BUILDING IS READY FOR COMMISSIONING. THE CONTRACTOR SHALL SOLELY BE RESPONSIBLE FOR PUMPING AND TRANSPORT OF SLUDGE AND SCUM FROM THE SEDIMENT TREATMENT TANKS FROM THE TIME THAT THE EXISTING PUMPS ARE REMOVED FROM SERVICE UNTIL THE NEW PUMPS AND SLUDGE HANDLING FACILITIES ARE COMMISSIONED AND ACCEPTED FOR OPERATION BY THE CITY
REPLACE EXISTING SLUDGE AND SCUM PUMPS, SEE MECHANICAL DRAWINGS
FOR INTERCONNECTION DETAILS SEE M-MECHANICAL DRAWINGS
900 SE PVC, SEE PLAN AND PROFILE DWG. C-11
REMOVE AND REPLACE EXISTING COARSE BUBBLE DIFFUSERS
INSTALL 150 CLEANOUT w/ 350x150 WYE AND END CAPS
PROPOSED NEW CHAIN LINK FENCE AROUND THE PERIMETER OF THE PROPERTY LINE
450 PVC TEMPORARY CONSTRUCTION CONNECTION. SEE PLAN AND PROFILE DWG. C-10
ELECTRICAL DUCT BANK
AIR CONDENSER
TERTIARY TREATMENT AND UV BUILDING
ELECTRICAL RMA, SEE DWG E-02
35 ALL PVC (x2) DOUBLE WALL
450 WE PVC
450 SE PVC
450 WE PVC
6m WIDE TURNITCHL ACCESS
PROPOSED HYDRANT
CLAR FLSR
TRAVERSE
AERATION ENGINE
35 ALL PVC DOUBLE WALL (TOTAL 4 PIPES)
ISSUED FOR MOE APPROVAL
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City of Anytown
ACME WWTP EXPANSION
PROPOSED SITE FACILITY AND PIPING PLAN
CONSULTING LTD.
Project Manager: AS
Reviewed By: DD
Designed By: DF
Drawn By: MH
Scale: 1:200
Project No: 53469-02
Revision No: 010
Drawing No: C-03



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City of Anytown

ACME WWTP EXPANSION

SECONDARY TREATMENT
HYDRAULIC PROFILE
SHEET 1 OF 3

CONSULTING LTD.

Project Manager: AB	Reviewed By: DD	Designed By: EF	Drawn By: MH
Checked: MRS	Project No: 53469-02	Report No: 010	Drawing No: C-15

ARCHITECTURAL NOTES:

GENERAL

1. ALL DIMENSIONS ARE IN MILLIMETERS AND ELEVATIONS ARE IN METRES UNLESS NOTED OTHERWISE.
2. DO NOT SCALE DRAWINGS. CHECK ALL DIMENSIONS ON SITE BEFORE PROCEEDING WITH THE WORK. REPORT ANY DISCREPANCIES BETWEEN DRAWINGS AND SPECIFICATIONS TO THE CONSULTANT BEFORE PROCEEDING WITH THE WORK.
3. ALL WORK SHALL COMPLY WITH CURRENT requirements OF THE ONTARIO BUILDING CODE, THE MUNICIPALITY OF ANYTOWN AND ANY OTHER BODIES HAVING JURISDICTION. WORK SHALL COMPLY WITH ALL LOCAL AND PROVINCIAL REGULATIONS AND WITH APPLICABLE C.S.A. STANDARDS. IN ALL CASES THE LATEST EDITIONS OF CODES AND STANDARDS SHALL APPLY.
4. STEEL SHALL DESIGN COMPLY WITH THE MINIMUM REQUIREMENTS OF DIVISION B, PART 4 OF THE ONTARIO BUILDING CODE (OBC).
5. LOCATE ALL BUILDING SERVICES PRIOR TO EXCAVATION. SEE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL TEMPORARY BRACING, SHORING AND UNDERPINNING NECESSARY TO ACCOMMODATE THE WORK.
6. THE CONTRACTOR IS RESPONSIBLE FOR REMOVING EXCESS MATERIALS AND CLEANING UP ON COMPLETION OF THE WORK.
7. DIMENSIONS, FLOORS, DOOR LOCATIONS AND ORIENTATION OF OPENINGS AND EMBEDMENTS IN CONCRETE WITH RELEVANT MECHANICAL, ELECTRICAL DRAWINGS.
8. REFER TO SEE DRAWINGS IN CONJUNCTION WITH ALL RELATED STRUCTURAL, MECHANICAL, ELECTRICAL AND CIVIL DRAWINGS AND CONTRACT DOCUMENTS.

EXCAVATION

1. PROTECT FOOTINGS, SPLAYS, SLABS ON GRADE AND ADJACENT SOIL AGAINST FROSTING. PROVIDE HEATERS AND HEATED ENCLOSURES AS REQUIRED DURING CONSTRUCTION.

CONCRETE

1. ALL CONCRETE FLOORS SHALL RECEIVE AN EPOXY COATING IN ACCORDANCE WITH THE SPECIFICATIONS.

MISCELLANEOUS METALS

1. ALL MISCELLANEOUS METAL ACCESS HATCHES, GRATING, STAIR TREADS, PRECAST CONCRETE PAN STAIRS, EMBEDDED ANCHOR SUPPORT ANGLES AND LADDERS, SHALL BE STAINLESS STEEL ALLOY 316L.
2. ALL MISC PLATES/ANCHORS SHALL BE MADE FROM STEEL IN PLACE CONCRETE TRENCH AND LANDINGS AS SHOWN. MOTOR PAN BASES, ALL STAIR STRINGERS, AND ALL GUYLINE BRACING SHALL BE HOT DIP GALVANIZED AFTER FABRICATION. UNLESS NOTED OTHERWISE.
3. ALL INVERT MANHOLE AND CONCRETE ANCHOR BOLTS SHALL BE STAINLESS STEEL ALLOY 316 UNLESS NOTED OTHERWISE.

ROOM FINISH SCHEDULE

FLR	ROOM		FLOOR		WALLS										CEILING		STAIRS	DOORS, WINDOWS & TRIM	REMARKS
					NORTH		SOUTH		EAST		WEST								
	NO	NAME	MATERIAL	SYSTEM / COLOUR	MATERIAL	SYSTEM / COLOUR	MATERIAL	SYSTEM / COLOUR	MATERIAL	SYSTEM / COLOUR	MATERIAL	SYSTEM / COLOUR	MATERIAL	SYSTEM / COLOUR	MATERIAL	SYSTEM / COLOUR	SYSTEM / COLOUR	SYSTEM / COLOUR	
0042	101	RECEPTION ROOM	CONCRETE	09 / GREY	BLOCK	117 / WHITE	BLOCK	117 / WHITE	BLOCK	117 / WHITE	BLOCK	117 / WHITE	CEMENT BOARD	117 / WHITE	–		–	157	COLOUR SAMPLES SHALL BE REVIEWED TO CONFIRM UNIT FOR SELECTION
0xx	102	SLUDGE THICKENER ROOM	CONCRETE	09 / GREY	BLOCK	112 / WHITE	BLOCK	117 / WHITE	BLOCK	112 / WHITE	BLOCK	117 / WHITE	CEMENT BOARD	117 / WHITE	117	157	–	157	
0xx	103	POLYMER ROOM	CONCRETE	09 / GREY	BLOCK	112 / WHITE	BLOCK	117 / WHITE	BLOCK	112 / WHITE	BLOCK	117 / WHITE	CONCRETE TO STEEL DECKING	117 / WHITE	–		–	157	
0xx	104	ELECTRICAL ROOM	CONCRETE	09 / GREY	BLOCK	112 / WHITE	BLOCK	117 / WHITE	BLOCK	112 / WHITE	BLOCK	117 / WHITE	CEMENT BOARD	117 / WHITE	–		–	157	
BSMT	201	DRYWELL	CONCRETE	09 / GREY	CONCRETE	112 / WHITE	CONCRETE	117 / WHITE	CONCRETE	112 / WHITE	CONCRETE	117 / WHITE	CONCRETE	117 / WHITE	117	157	–	157	

DOOR AND WINDOW SCHEDULE

MARK	QTY	DESCRIPTION	DIMENSION	MATERIAL	DOOR AND FRAME DESCRIPTION	HARDWARE DESCRIPTION	REMARKS
D1	2	EXTERIOR DOOR	914mmW x 2134mmH THK	HOLLOW METAL, INSULATED	INSULATED, 1.2mm MTBR, THICK SHEETS, 2.3mm STEEL, ERMINIDE FLUSH TOP AND BOTTOM, 1.2mm FULLY WELDED STEEL FRAME, 220mm DEPTH		1100x2200 ACTUAL DOORWAY OPENING
D2	2	EXTERIOR DOOR	1829mmW x 2134mmH THK	SAME AS D1	SAME AS D1	SAME AS D1 EXCEPT 2 PAIR EXIT BALL BEARING HINGES	3200x2700 ACTUAL DOORWAY OPENING
D3	1	EXTERIOR DOOR	4000x4000	ENGINEERED INSULATED ROLL-UP COIL			STEEL, INSULATED SECTIONAL DOOR WITH ELECTRIC MOTOR OPERATOR, SEALS WEATHERSTRIPPED, SEE SPEC.
D4	1	EXTERIOR DOOR	1829mmW x 2134mmH THK	SAME AS D1	SAME AS D1	SAME AS D2	3200x2700 ACTUAL DOORWAY OPENING
D5	2	INTERIOR DOOR	914mmW x 2134mmH THK	HOLLOW METAL, INSULATED	SAME AS D1	SAME AS D1	1100x2200 ACTUAL DOORWAY OPENING, 45 MIN FRR
H1	1	INTERIOR FLOOR HATCH	1800x1800	CONCRETE			45 MIN FRR
H2	2	INTERIOR FLOOR HATCH	1219x1829	MFT			
W1	4	EXTERIOR WINDOW	6096x2438				CLASS B CWEC II ZONE/TYPE STYLE. GLAZING BARS TO BE MOUNTED ON THE EXTERIOR FACE OF THE WINDOW, W STONE SILL AS FURNISHED BY MING ENGLAND CLIENT FINISH SAMPLE PROVIDED BY CONTRACTOR.

LINTEL SCHEDULE

SPAN	ANGLE SIZE	ANGLE DIRECTION	NUMBER REQUIRED
900	89x76x6	LLH	ONE ANGLE FOR EACH 200 OF WALL THICKNESS
1200	89x89x6		
1500	102x102x6		
1800	127x89x6		
2100	127x102x6	LLV	
2400	127x127x6		
2700	152x102x6		
3000	152x152x6		

NOTES:
1. LINTELS ARE FOR OPENINGS IN HOLLOW CONCRETE MASONRY UNIT WALLS SUPPORTING WEIGHT OF MASONRY UNITS ON PRESCRIBED ONLY.
2. ALL LINTELS SHALL BE HOT DIP GALVANIZED AFTER FABRICATION.
3. SEE SHOP NO DETAILS FOR LARGER SPANS THAN SHOWN OR SPAND RECEIVING RECEPTION LOADS, SEE DRAWING A-05.
4. MIN. BEARING FOR LINTEL ANGLES SHALL BE 152mm UNLESS NOTED OTHERWISE.
5. MULTIPLE LINTEL ANGLES SHALL BE STITCH WELDED AT 600 O.C.

	Rice Mews Consulting Ltd. Certificate of Practice Number: 125 Dillon Drive Barrington, Ontario K0K 2M0 P: 000-000-0000 F: 000-000-0000 Name of Project: ACME WWTP EXPANSION Location: BOULEVARD RD. ANYTOWN, ON		
Item	Ontario Building Code Data Matrix Parts 3 & 9		OBC 2024 Reference
1	Project Description: NEW SLUDGE HANDLING BUILDING ATTACHED TO EXISTING PART 3, NONRESIDENTIAL BUILDING. NO CHANGE OF USE OR ALTERATION TO EXISTING. ☐ Change of Use ☐ New ☑ Addition ☐ Alteration ☐ Dlr B, Part 11 ☐ 11.1 to 11.4 ☑ Dlr B, Part 9		Dlr A, 1.1 ☐ Dlr B, Part 9 ☐ Dlr A,1.1 6.10.1.3
2	Major Occupancy(s):	F2	3.1.2.1.(1f) 6.10.3
3	Building Area (m²):	Existing: 394.0m² New: 282.7 m² Total: 4676.8 m²	Dlr A,1.4.1.3 Dlr A,1.4.1.2
4	Gross Area (m²):	Existing: 394.0m² New: 282.7 m² Total: 4676.8 m²	Dlr A,1.4.1.2 Dlr A,1.4.1.2
5	Number of Storeys:	Above Grade: 1 Below Grade: 1	3.2.1.1 & Dlr A, 1.4.1.2 Dlr A,1.1.2.4
6	Number of Streets / Access Routes:	2	3.2.2.10 & 3.2.5.5 6.10.3B
7	Building Classification:	F2 - MEDIUM HAZARD INDUSTRIAL	3.3.2 6.10.4
8	Sprinkler System Proposed:	☐ Entire Building ☐ Basement Only ☐ In Lieu of Roof Rating ☑ Not Required	3.2.2.18 6.10.5
9	Standpipe Required:	☐ Yes ☑ No	3.2.9
10	Fire Alarm Required: (Provided)	☐ Yes ☑ No	3.2.4 6.10.10.2
11	Water Service/Supply is Adequate:	☑ Yes ☐ No	3.2.5.7
12	High Building:	☐ Yes ☑ No	3.2.6
13	Permitted Construction: ☐ Combustible ☐ Non-Combustible ☑ Both Actual Construction: ☐ Combustible ☐ Non-Combustible ☑ Both		3.2.2.20 - 83 9.10.6
14	Mezzanine(s) Area (m²):	SERVICE PLATFORMS AROUND THICKENER TANKS	3.2.1.1.(3)-(5) 6.10.4.1
15	Occupant Load Based on: ☐ m² / person ☑ Design of Building Basement: Classroom: – Load: – Persons 1st Floor: Classroom: 2 Load: – Persons 2nd Floor: Classroom: – Load: – Persons 0 TOTAL MAX. PART TIME		3.1.17 6.6.1.2
16	Barrier-Free Design:	☐ Yes ☑ No (Occupancy not on 0.6 floor levels)	3.5 6.6.2
17	Hazardous Substances:	☐ Yes ☑ No	3.3.1.2. & 3.2.1.1.18 6.10.1.3(6)
18	Required Fire Resistance Rating (FRR):	Horizontal Assemblies FRR (Hours): Floors: 45 Min; Roof: 0 Hours; Mezzanine: N/A Hours Listed Design No. Or Description (Dlr-2): CLT CONCRETE PER 3.2.1.1 IN 4B-II 200 TK —	3.2.2.71 & 3.2.1.4 3.2.1.1.(2) 6.10.8 6.10.5
		FRR of Supporting Members (Hours): 45 Min; Floors: N/A Hours; Roof: – Hours; Mezzanine: – Hours Listed Design No. CLT: CONCRETE Or Description (Dlr-2): —(N/A); —(N/A); —(N/A)	
20	Spatial Separation - Construction of Exterior Walls:		3.2.3 9.10.14
	Wall	Area of EBF (m²): North 434.7; South 434.7; East 116.6; West N/A	L.D (m): 23.6; >25; 12; –	L.D/H or H/L: –; –; –; –	Permitted Max % of Openings: 88; 100; 37; –	Proposed % of Openings: 20.2; 14.3; 0; –	FRR (Hours): 1; HR; 1; –	Listed Design or Description: 200mm BLOCK; > 3 HR FRR; TYP ALL EXT; WALLS	Comb. Const.: –; –; –; –	Comb. Constr. Mem. Cladding: –; –; –; –	Non-Comb Constr.: YES; YES; YES; YES
21	Other - Describe:	ENCLOSED EXIT FROM BASEMENT, 45 MIN FRR									

ISSUED FOR MOE APPROVAL

SCALE VERIFICATION: THIS BAR MEASURES 50mm ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

No	Revision	Date	Initial

Approval

PLACE ENGINEER'S STAMP HERE

City of Anytown

ACME WWTP EXPANSION

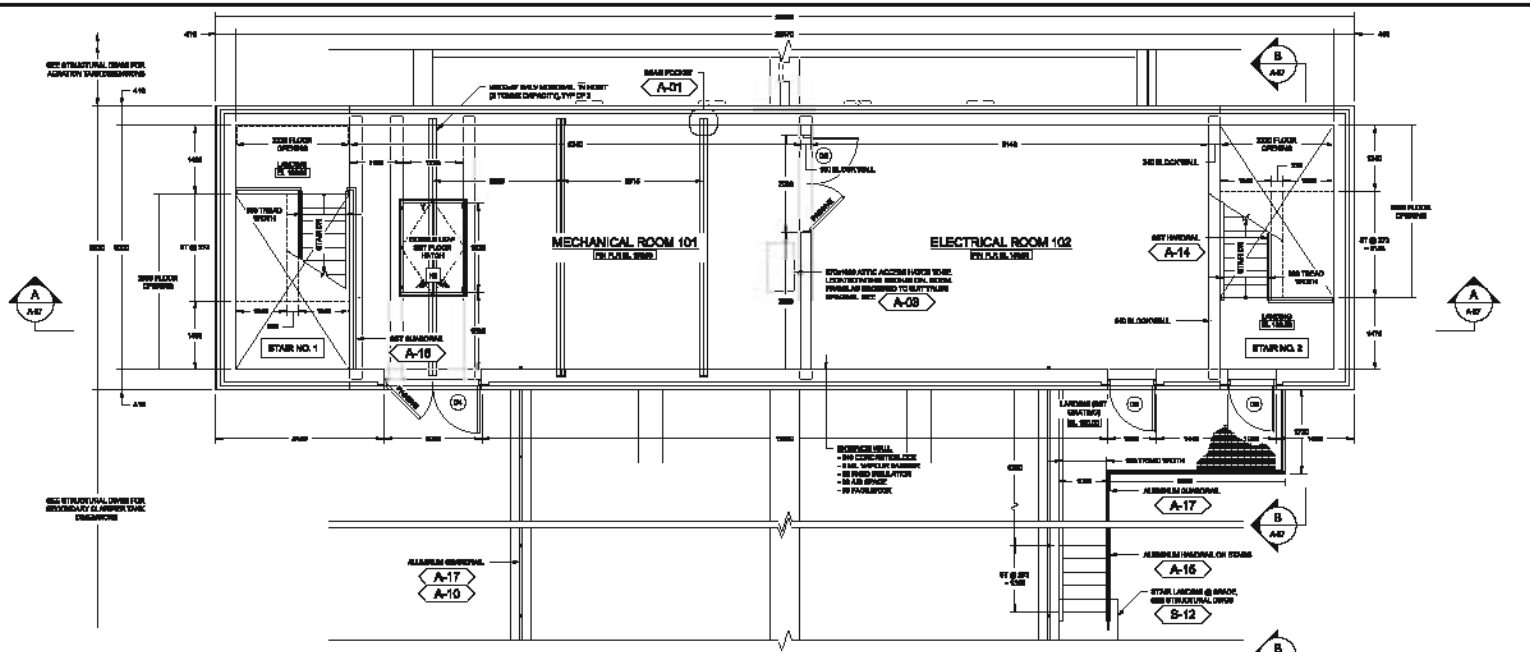
SLUDGE HANDLING BUILDING
ARCHITECTURAL NOTES
AND SCHEDULES

CONSULTING LTD.

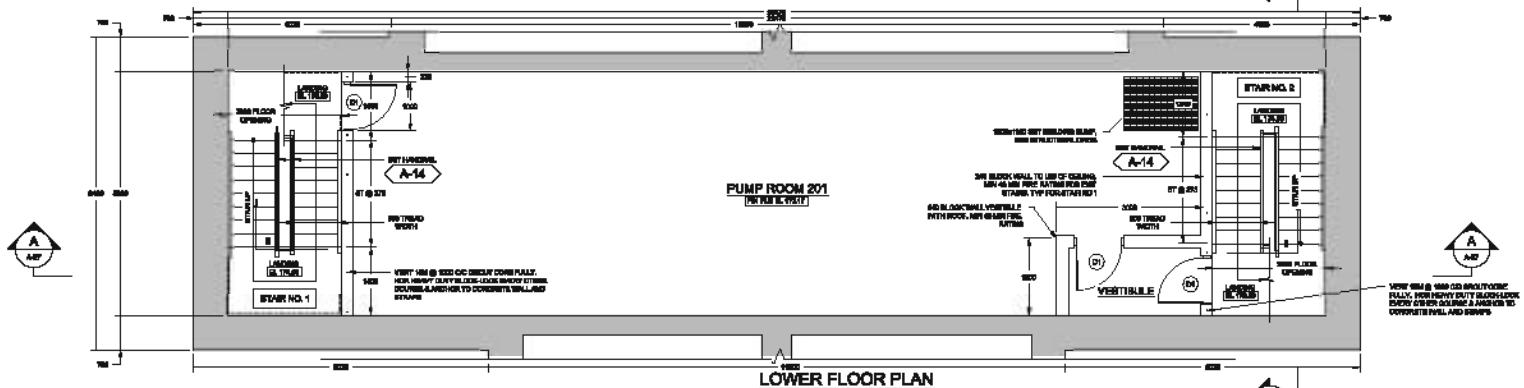
Drawn Reference: Date: AUG 2025

Project Manager	Reviewed By	Designed By	Drawn By
AB	DD	EF	MH

Scale	Project No.	Report No.	Drawing No.
NTS	53469-02	010	A-01



UPPER FLOOR PLAN



LOWER FLOOR PLAN

ISSUED FOR MOE APPROVAL

PLACE ENGINEER'S STAMP HERE

City of Anytown

ACME WWTP EXPANSION

RAS - WAS BUILDING
UPPER & LOWER
FLOOR PLANS

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Project Manager: AB	Reviewed By: DD	Designed By: EF	Drawn By: BH
Scale: 1:50	Project No: 53469-02	Report No: 010	Drawing No: A-20

GENERAL NOTES

1. THE DESIGN AND CONSTRUCTION OF ALL WORK ON THIS PROJECT SHALL CONFORM TO THE ONTARIO BUILDING CODE 2006 INCLUDING ALL AMENDMENTS, THE MUNICIPAL LIMITED DWA, AND AN STANDARDS INCLUDING THE LATEST REVISIONS, AND THE CONTRACT SPECIFICATIONS.
2. READ THESE DRAWINGS IN CONJUNCTION WITH ALL RELATED WORKS INCLUDING ARCHITECTURAL, MECHANICAL, ELECTRICAL AND CIVIL DRAWINGS AND CONTRACT DOCUMENTS.
3. THE CONTRACTOR SHALL CHECK AND VERIFY ALL CONDITIONS AND MEASUREMENTS AT THE SITE AND REPORT TO THE ENGINEER ANY DISCREPANCIES OR UNSATISFACTORY CONDITIONS WHICH MAY ADVERSELY AFFECT THE PROPER COMPLETION OF THE JOB BEFORE PROCEEDING WITH THE WORK.
4. DO NOT SCALE DRAWINGS.
5. DESIGN LIVE LOADS FOR EACH PORTION OF THE STRUCTURE ARE AS INDICATED ON THE DRAWINGS. DO NOT EXCEED THESE LOADS DURING CONSTRUCTION.
6. DESIGN LOADS INDICATED ARE UNFACTORED UNLESS NOTED.
7. CONSTRUCTION, EXAMINATION, & SHOP DRAWING REQUIREMENTS ARE PROVIDED AS PER OBC.
8. REFERENCE ELEVATIONS SHOWN CORRESPOND TO ACTUAL GEODETIC ELEVATION, IN METRES.
9. ALL DIMENSIONS OR DRAWINGS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE.
10. APPROVED SHALL MEAN APPROVED IN WRITING BY THE STRUCTURAL ENGINEER OF RECORD.
11. DELIVER, HANDLE AND STORE MATERIALS TO AVOID DAMAGE IN ANY MANNER.
12. MAINTAIN A SET OF DRAWINGS ON SITE & UPDATE FREQUENTLY WITH CORRECTION RECEIVED INFORMATION

CONSTRUCTION JOINTS

1. CONSTRUCTION JOINTS SHALL BE MADE AND LOCATED SUCH AS NOT TO IMPAIR THE STRENGTH OF THE STRUCTURE. IF CONSTRUCTION JOINTS ARE NOT SPECIFICALLY LOCATED AND TIMED IN ANY CASE THEY CONCRETE FOR THIS LOCATION, THE CONTRACTOR SHALL CONSULT WITH THE ENGINEER.
2. WHERE A CONSTRUCTION JOINT IS TO BE MADE, THE SURFACE OF THE SET CONCRETE SHALL BE THOROUGHLY ROUGHENED, AND SET IN DAMP CONDITION WITH NO FREE WATER ON THE SURFACE, IMMEDIATELY BEFORE PLACING ADJACENT CONCRETE.
3. REINFORCING STEEL PROJECTED THROUGH A CONSTRUCTION JOINT SHALL BE THOROUGHLY CLEANED OF PLAST PAINT, MUD, OIL, ERED CONCRETE OR OTHER CONTAMINANTS WHICH WOULD DESTROY OR REDUCE THE BOND.

MATERIALS

UNLESS NOTED OTHERWISE ON THE DRAWINGS THE FOLLOWING MATERIALS SHALL BE USED FOR CONSTRUCTION. SEE ALSO ARCHITECTURAL DRAWINGS FOR ADDITIONAL CONCRETE AND MISC. METALS MATERIAL REQUIREMENTS.

1	CONCRETE:	SLABS ON GRADE:- 32 MPa - 28 DAY MIN. COMP. STRENGTH, EXPOSURE CATEGORY F1 TO CSA A23.1 FOUNDATION WALLS, FOOTINGS, FLOOR SLABS AND BEAMS - 25 MPA - 28 DAY MIN. COMP. STRENGTH, EXPOSURE CATEGORY F1 TO CSA A23.1
2.	GROUT:	35MPa - 28 DAY MIN. COMP. STRENGTH NON SHRINK, NON METALLIC, ASTM C1 MINOMYM
3.	REINFORCING BAR:	MILL TEST REPORTS TO CARBON CONTENT, MECHANICAL PROPERTIES, WELDING IS REQUIRED.
4.	WELDED WIRE REINFORCEMENT:	ASTM A185M/M
5.	ANCHOR RODS, NUTS AND WASHERS:	STAINLESS STEEL, ALLOY 316, TO ASTM F593 FOR RODS, F594 FOR NUTS AND JOHN FORTMAN SPEC.
6.	HSS STEEL:	ASTM A500 OR A999 (FOR CHS), GRADE C, STEEL SHALL BE STAINLESS STEEL. DIMENSIONS FOR STYLES, SEE STEEL DESIGNER FOR DETAILS.
7.	STEEL SHAPES & PLATES	CAN/CSA-G40.21-400W (300W FOR PLATE)
8.	HSS:	CAN/CSA-G40.21-350W CLASS H
9.	PIPES:	STEEL PIPE, TO ASTM A53/A53M GRADE B Fy = 240 MPa MIN.
10.	BOLTS/NUTS:	CSA G164
11.	WELDING:	CSA W59, W55 AND W57 ENGINEER SHOP DRAWINGS FOR WELDING STEEL. ALL STAINLESS STEEL WELDING SHALL BE IN CONFORMANCE WITH THE STRUCTURAL WELDING CODE - STAINLESS STEEL, AWS D1.6 AND USING COMPATIBLE RODS. FILLER RODS OR ELECTRODES.
12.	MASONRY BLOCK:	15MPa COMPRESSIVE STRENGTH OR BEST AVAILABLE TO CSA A165 SERIES
13.	MORTAR:	TYPE S TO CSA A179
14.	GROUT MASONRY:	MIN 25 MPA STRENGTH OF 300 PART, U.N.O.
15.	"MISC STEEL" (MASONRY):	ASTM A36/M36 OR A1008/A1008M, HOT DIP GALVANIZED TO CSA G164
16.	COLD FORMED STEEL FRAMING:	MIN 50MM, IDENTIFIED AS TO MANUFACTURER, MECHANICAL PROPERTIES AND MISCELLED COATINGS.
17.	STAINLESS STEEL:	ALL STAINLESS STEEL SHEET, PLATE, ROLLED FITS MATERIAL SHALL BE TYPE 304, WITH A MINIMUM YIELD STRENGTH OF 205MPa(30ksi). STAINLESS STEEL SHAPES (BEAMS, CHANNELS AND ANGLES) SHALL BE TYPE 304, OR 316, WITH A MINIMUM YIELD STRENGTH OF 205MPa(30ksi). ALL STAINLESS STEEL SHEET, STRIP, PLATE, AND BAR SHALL CONFORM TO ASTM A240. ALL STAINLESS STEEL BARS AND SHAPES SHALL CONFORM TO ASTM A276. ALL BOLTS FOR STAINLESS STEEL MEMBERS SHALL BE STAINLESS STEEL AND CONFORM TO ASTM F593, GROUP II, ALLOY 316. ALL CONNECTIONS SHALL HAVE BUSHED STAINLESS STEEL SLIP INSERTS CONFORMING TO ASTM F594 AND WASHERS CONFORMING TO ASTM A666.

FOUNDATION:

1. FOUND SHALLOW SPREAD FOOTINGS AND SLABS ON GRADE ON A MIN 600mm THICK BASE OF GRANULAR 'A' (OPSS 1010) COMPACTED TO 100% SPMDD. IN ALL CASES, SPREAD FOOTINGS SHALL HAVE AT LEAST 1500mm COVER. FOR FROST PROTECTION. FAILURE TO ACHIEVE THE MINIMUM BEARING RESISTANCE OF 150 psf (47.364 kPa) AT BELOW ALL SLABS OR BRACE.
2. FOUND LOWER FOUNDATION/BASE SLABS ON NATIVE CLAYEY SILT/SILTY CLAY/TILL FOOTINGS SHALL BE FOUNDED AT LEAST 600mm INTO MATURE TILL. PRESPROUT COMPETENT MATERIAL ELSEWHERE. REMOVE SOFT MATERIALS ON FILL MATERIALS AND REPLACE WITH ENGINEERED FILL COMPACTED TO 100% SPMDD. ALL FOUNDATION DESIGNS BASED ON AN ASSUMED MAT BEARING RESISTANCE OF 200 kPa (4,180 psf) AND SPs (LLS). ENSURE RESISTANCE SHALL BE CONFIRMED ON SITE BY A QUALIFIED GEOTECHNICAL ENGINEER.
3. MAINTAIN UNsupported SIDES OF EXCAVATION ONLY IF SAFE INCLINATION OF THE SIDES OF THE EXCAVATION IS PROVIDED IN ACCORDANCE WITH THE OBC REGULATIONS. ENGINEERS RECOMMENDATIONS AND/OR MUNICIPAL OR PROVINCIAL REGULATIONS.
4. EFFECT, MAINTAIN AND IF REQUIRED, REMOVE A WATER TIGHT DEWATERING SYSTEM ALONG THE SIDES OF THE EXCAVATIONS. SHOULD OF SUCH SYSTEM SHALL BE IN ACCORDANCE WITH THE SOIL REPORT RECOMMENDATIONS AND DESIGNED AND SEALED BY A PROFESSIONAL ENGINEER IN ONTARIO.
5. PROTECT SOIL FROM FREEZING ADJACENT TO AND BELOW ALL FOOTINGS AND SLABS ON GRADE AT ALL TIMES.
6. BACKFILL AGAINST FOUNDATION WALLS IN ACCORDANCE WITH THE GEOTECHNICAL REPORT DO NOT BACKFILL AGAINST WALLS WITH THE CONCRETE STRENGTH HAS BEEN ACHIEVED. THE DESIGN STRENGTH. NOTE MAXIMUM ALLOWABLE BACKFILL HEIGHTS FOR BASEMENT WALLS PRIOR TO CASTING THE FLOOR SLAB AS SHOWN ON THE DRAWINGS.
7. ALL BACKFILL MATERIAL SHALL BE FREE OF DELETERIOUS MATERIAL AND PLACED IN LOOSE LIFT THICKNESSES NOT EXCEEDING 300 mm COMPACTED TO NOT LESS THAN 98% SPMDD (SIMILAR TO "B" TO OPSS 1010 OR OTHER APPROVED GRANULAR BACKFILL MATERIAL)
8. REFERENCE SOIL TECH GEOTECHNICAL REPORT (JULY 3, 2020).

BUILDING AND TANK DESIGN

DESIGN LOADS (ALL UNFACTORED)

1. FLOOR LOADS
   - a) DEAD LOAD
     SUBMERGED SLABS (PER 25 mm THICKNESS) — 0.6 kPa
   - b) LIVE LOADS
     FLOORS — 4.8 kPa
     MISSILE PLATFORMS, GRATING AND HATCHES (LLSJ) — 4.8 kPa
     WHEEL DOG PRESENTATION AND AXLE LOAD PER AXLE (2 OHT DOOR OR EQUALTON, ROOM PER LANE BOUARD DOOR — 145 kN
2. EQUIPMENT LOADS
   - ALUMINE TRAMMER, TANDEM 4 t OR 6 t OVER 4 LEGS AS PORT LOADS
   - LIVE LOAD — 117 kN/LEG
   - DEAD LOAD — 19.1 kN/LEG
   - CLARIFIERS: DIA. 8.8Mm
   - LIVE LOAD — 192 kN/TANK
   - DEAD LOAD — 4.45 kN/TANK
   - SLUDGE — 1.1 kN/SQMT
3. ROOF LOADS
   - DEAD LOAD — 0.84 kPa
   - SNOW AND ASSOCIATED RAIN LOAD — 1.53 kPa
   - (1/50 S_s = 1.13 kPa, Sr = 0.4 kPa)
   - IMPORTANCE FACTOR, Is (SLS) — 1.36
4. WIND LOADS
   - q (VELOCITY PRESSURE) (KN/SQM) — 0.58 kPa
   - Cb (ENGINEERS FACTOR (SLS)) — 1.2
   - IMPORTANCE FACTOR, Iw — 1.00
   - Cgt 2 FOUNDATIONS, PRESSURE
5. EARTHQUAKE LOADS
   - SITE CLASS D
   - Sa(0.2) — 0.84
   - Sa(0.5) — 0.53
   - Sa(1.0) — 0.309
   - Sa(2.0) — 0.216
   - PGA — 0.45
   - IMPORTANCE FACTOR, Ie — 1.0
6. OTHER
   - LATERAL SOIL, γ = 20 kN/m³, γ_sat = 24 kN/m³, Ko = 0.5 (DRAINED/UNDRAINED)
   - LIVE LOAD SURCHARGE OF 10kPa, INCL. HZ. OF SOIL
   - HYDROSTATIC LOADS (AND BUOYANCY EFFECTS), WATER TABLE TO BASE, SUBMERGED TANK FOR FLOTATION
   - SINGLE OR MULTIPLE AND SECONDARY TREATMENT STRUCTURES, 1/7 day FOR PRIMARY TREATMENT BUILDING

CAST-IN-PLACE CONCRETE

1. CONCRETE MATERIALS AND METHODS OF CONCRETE CONSTRUCTION CSA-A23.1, CODE FOR THE DESIGN OF CONCRETE STRUCTURES FOR BUILDINGS (CAN/CSA-A23.3). ALL CONCRETE WATER RETAINING STRUCTURES ARE ALSO DESIGNED, AND TO BE CONSTRUCTED, IN ACCORDANCE WITH ACI 350-01, CODE REQUIREMENTS FOR ENVIRONMENTAL CONCRETE STRUCTURES AS WELL AS CITY OF ANYTOWN ENGINEER GUIDELINES, SECTION 5—STRUCTURAL.
2. THE CLEAR DISTANCE BETWEEN REINFORCING STEEL AND SURFACE OF CONCRETE SHALL BE AS FOLLOWS, U.N.O.:
   - SLABS ON GRADE — 50mm — TO TOP, 75mm TO BOTTOM (50mm "BOTTOM" AT ABUTMENTS AND CLARIFIER DRAIN BASE SLAB)
   - WALLS, SLABS, BEAMS — 50mm
   - FOOTINGS — 75mm — TO BOTTOM (CAST AGAINST EARTH), 50mm TO TOP
   - BEAMS — 40mm — TO STIRRUPS (CONCRETE ENVIRONMENT)
3. CONCRETE COVER FOR REINFORCING SHALL BE IN ALL CASES AT LEAST EQUAL TO 1.5 TIMES THE BAR DIAMETER AND 1.5 TIMES NOMINAL MAXIMUM AGGREGATE SIZE.
4. ALL REINFORCING BARS SHALL BE SUPPORTED IN THE FORMS AND SPACED WITH STANDARD ACCESSORIES.
5. FORMWORKING IS TO BE GENERALLY SECONDS-HAND PLYWOOD IN ACCORDANCE WITH RULES, SHAPE, OF STANDARD PRACTICE. EXTENT, DIMENSIONS FOR REINFORCING SHOWN ON DRAWINGS AS GIVEN IN PLANS MANUAL.
6. CONCRETE PLACING, CURING AND TESTING TO CONFORM TO CSA A23.1 AND A23.2.
7. FORMWORK AND FALSEWORK TO CONFORM TO CSA A23.1
8. NO CUTTING OR DRILLING IN HARDENED CONCRETE IS PERMITTED WITHOUT WRITTEN AUTHORIZATION FROM THE ENGINEER.
9. SHOP DRAWINGS OF BENDING PLANS OF STEEL, DOWELS AND STEEL BEAMS WITH DIMENSIONS AND BENDING DETAILS TO MANUFACTURING INSTRUCTIONS. SHOPPING SHALL BE COMPLETED PRIOR TO LAB LOADING OF THE STRUCTURE.
10. FOR THICKNESS OF SLAB ON GRADE SEE FOUNDATION PLAN AND MAINTAIN SLAB THICKNESS AS ALL DEPRESSIONS. REFER TO WORKMANSHIP FOR LOCATION AND EXTENT OF PITS AND ASSOCIATIONS.
11. ALL EMBEDDED STEEL EXPOSED TO THE WEATHER OR EXTERIOR WALL EXPOSED SHALL BE HOT DIP GALVANIZED.
12. ALL REINFORCING STEEL IN PLACE TO BE INSPECTED BY ENGINEER BEFORE PLACING CONCRETE.
13. ISOLATION JOINT MATERIAL SHALL BE NOT less THICK, ASPHALT IMPREGNATED FIBREBOARD, STYROFOAM OR EQUAL, COVERED WITH JOINT SEALANT
14. MIN FORCING LAP LENGTH IS SHALL BE

REBAR SIZE	STRAIGHT EMBEDMENT LENGTH	EMBEDMENT LENGTH WITH HOOK	CONTINUOUS LAP LENGTH	TENSION LAP LENGTH CLASS B
10M	300	200	350	500
15M	450	300	525	750
20M	600	400	700	975
25M	800	500	900	1150

SLOPE BASED ON REINFORCED CONCRETE WITH 15 A SLOPE AND SLAB/C STEEL. POINT OF STRENGTH MORE THAN 300mm THICK FROM CONCRETE, MULTIPLY LAP LENGTHS BY 1.3.

15. EXPOSED EDGES SHALL HAVE 15 mm CHAMFER.
16. PADS AND SLABS SHALL BE TROWEL FINISHED TO WITHIN 5mm OF ELEVATIONS SHOWN ON DRAWINGS. FOLLOWING TROWELLING, PITCH AND BROOM FINISH OUTSIDE CONCRETE PADS.
17. PROVIDE CORNER REINFORCING BARS TO MATCH HORIZONTAL BARS AT CORNERS AND INTERSECTIONS FOR CONTINUITY.
18. PROTECT SPECIFIED AREAS "TOP SURFACE OF" LOW CONCRETE MUD SLAB UNDER SLABS, AND FOUNDATIONS AS NOTED ON DRAWINGS.
19. JOINT SEALANT SHALL BE ONE-COMPONENT POLYURETHANE TYPE PLUS AS BY ARE CHOSEN, EXPRESSION OR APPROVED EQUIVALENT.
20. ALL FOUNDATION INSULATION SHALL BE TYPE 4 EXTRUDED POLYSTYRENE BOARD INSULATION. PERIMETER FOUNDATION WALL INSULATION SHALL BE STYROFOAM SM INSULATION BOARD, EQUAL EXTERIOR WITH GALVANIZED CLIPS AND FASTENERS. BY DOW CHEMICAL COMPANY. FOUNDATION WALL INSULATION TO EXTEND MINIMUM 1200 BELOW FINISH GRADE OR THE DEPTH OF ALL SECTIONS, BUILDING AND TRANSITIONS. CLARIFIER AND INSULATION TRIMS SHALL NOT BE LEFT EMPTY FOR EXTENDED PERIODS OF TIME DURING FREEZING CONDITIONS.
21. WATERPROOFING MEMBRANE SYSTEM SHALL BE APPLIED TO ALL OUTSIDE SURFACES OF CONCRETE BELOW GRADE. SEE SPECIFICATIONS FOR PRODUCT DETAILS. PROTECT MEMBRANE FROM DAMAGE DURING BACKFILL OPERATIONS.

STRUCTURAL STEEL

1. STRUCTURAL STEEL SHALL BE HOT DIP GALVANIZED AFTER FABRICATION, GRADE STAINLESS STEEL, U.N.O. NOTED OTHERWISE. REINFORCING MATERIAL ONLY SHALL BE USED.
2. FABRICATION AND ERECTION TO CONFORM TO CAN/CSA S16-09 (LIMIT STATES DESIGN).
3. ALL FIELD BOLTS SHALL BE 19M ASTM A325 HIGH STRENGTH BOLTS (SNUG-TIGHT) UNLESS ALL GRADE OF NUTS (GRADE) HARDENED WASHERS SHALL BE PROVIDED UNDER THE ROTATING FACE OF THE NUT AND BOLT ASSEMBLY.
4. BOLT HOLES SHALL NOT BE LARGER THAN 2mm PLUS DIAMETER OF THE BOLT, A MINIMUM OF TWO BOLTS PER CONNECTION SHALL BE REQUIRED.
5. ALL BEAM TO BEAM AND BEAM TO COLUMN CONNECTIONS SHALL HAVE DOUBLE ANGLE CONNECTIONS, UNLESS OTHERWISE NOTED OR THE DESIGN DRAWINGS.
6. BEAMS, LINTELS, ETC. SHALL BE CENTERED OVER AND WELDED TO THEIR RESPECTIVE BEARING PLATES OR SUPPORTING MEMBERS UNLESS NOTED OTHERWISE.
7. THE CONTRACTOR SHALL SUBMIT SHOP DRAWINGS TO THE ENGINEER SHOWING ALL STRUCTURAL STEEL PRIOR TO PROCEEDING WITH ANY FABRICATION. ALL STRUCTURAL SHEET AND DRAWINGS, INCLUDING ALL CONNECTIONS, WELDS, BOLTS, TYPE, SIZE, OR A FORMAT SIMILAR TO THAT PROVIDED. ENGINEER IS CAUTIONED RESPONSIBLE FOR THE DETAILED CHECKING OF SHOP DRAWINGS. REPRODUCTIONS OR ELECTRONIC COPIES OF ENGINEERING DRAWINGS ARE NOT ACCEPTABLE.
8. THE STEEL ERECTOR SHALL BE RESPONSIBLE FOR PROVIDING TEMPORARY BRACING AS REQUIRED DURING CONSTRUCTION UNTIL ALL MEMBERS ARE IN PLACE, CONNECTED AND TIGHTENED.
9. WELDING SHALL CONFORM TO THE REQUIREMENTS OF CSA STANDARD W59. WELDERS MUST BE CERTIFIED TO W47.1 DIVISION 1 OR 2.
10. ALL ANCHOR RODS SHALL BE 316 STAINLESS STEEL, UNLESS NOTED OTHERWISE (SEE MATERIALS NOTES).

MASONRY

1. CONCRETE BLOCK WALL SHALL BE CONSTRUCTED IN RUNNING BOND USING HOLLOW CONCRETE BLOCK LAID WITH 10mm CONCRETE MORTAR JOINTS. HOLLOW CONCRETE BLOCK TO BE 15MPA.
2. IN ALL WALLS OF ENTRY TYPE OF MASONRY TO WHICH SHALL BE SOLID GROUTING SHALL BE DONE AT, AND ADJACENT TO ENTRY OPENING. MORTAR SHALL SHALL BE VERTICALLY SIDE FORCED. COMPLETE MORTAR SHALL RUN CELL HEIGHT OF WALL AND SHALL BE DOWELED INTO CONCRETE FOUNDATION. SOLID INTO REINFORCEMENT SHALL BE FULLY EMBEDDED. 15mm WALLS, 1-15M @ 400 O.C., 20mm WALLS, 1-15M @ 400 O.C.
3. MASONRY WALLS SHALL BE HORIZONTALLY REINFORCED. HORIZONTAL REINFORCEMENT SHALL BE BLOCK LADDER BETRA HEAVY DUTY GRADE GALVANNEALED EQUAL, SIMILAR OTHER BLOCK COURSE.
4. THE CONTRACTOR SHALL PROVIDE ADEQUATE TEMPORARY BRACEMENT TO HOLD FREE STANDING MASONRY WALLS PLUMB AND TRUE TO LINE DURING CONSTRUCTION.

WOOD ROOF SHEATHING, FRAMING AND TRUSSES

1. TIMBER SHALL BE No. 1 GRADE, SPECIES S.P.F. OR BETTER UNLESS NOTED OTHERWISE.
2. ALL PLYWOOD SHEATHING SHALL CONFORM TO CSA STANDARD O121 OR O154.
3. ALL PLYWOOD JOINTS ARE TO BE STAGGERED. NAIL ALL ROOF SHEATHING AT 150mm AT EDGES AND 300 c/c ELSEWHERE UNLESS NOTED OTHERWISE.
4. THE ROOF TRUSSES ARE TO BE PROPERLY TRUSSES DESIGNED FOR THE SPECIFIED LOADS IN ACCORDANCE WITH CAN/CSA-086. THE SHOP DESIGN IS TO PROVIDE SHOP DRAWINGS AND DESIGN CALCULATIONS SIGNED OR STAMPED BY A PROFESSIONAL ENGINEER, REGISTERED OR LICENSED IN THE PROVINCE OF ONTARIO. THE DRAWINGS MUST PROVIDE SCHEMATIC LOADS, TIMBER SPECIES, GRADE, SPACING AND CONNECTIONS. ALL TRUSSES MUST BE ARRANGED WITH THE DOWN BEGAL ANGLES.
5. THE BRACING SHOWN ON THE DRAWINGS IS THE MINIMUM NEEDED TO BE PROVIDED AND THE TRUSS MANUFACTURER MUST DESIGN TRUSSES TO MEET REQUIREMENTS.
6. PROVIDE STANDARD HANGERS BY SIMPSON, MMA, OR APPROVED EQUIVALENT.
7. ALL WOOD IN CONTACT WITH CONCRETE SHALL BE PRESSURE TREATED OR SHEATHED IN 6 mil POLY SHEET.
8. PERMANENT BRACING FOR TRUSSES SHALL BE SHOWN BRACED DIAGONALLY CUT AT 45 DEGREES TO SPECIFICATION.

ISSUED FOR MOE APPROVAL

SCALE VERIFICATION: THIS BAR MEASURES 50mm ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

No.	Revision	Date	Initial

Approval

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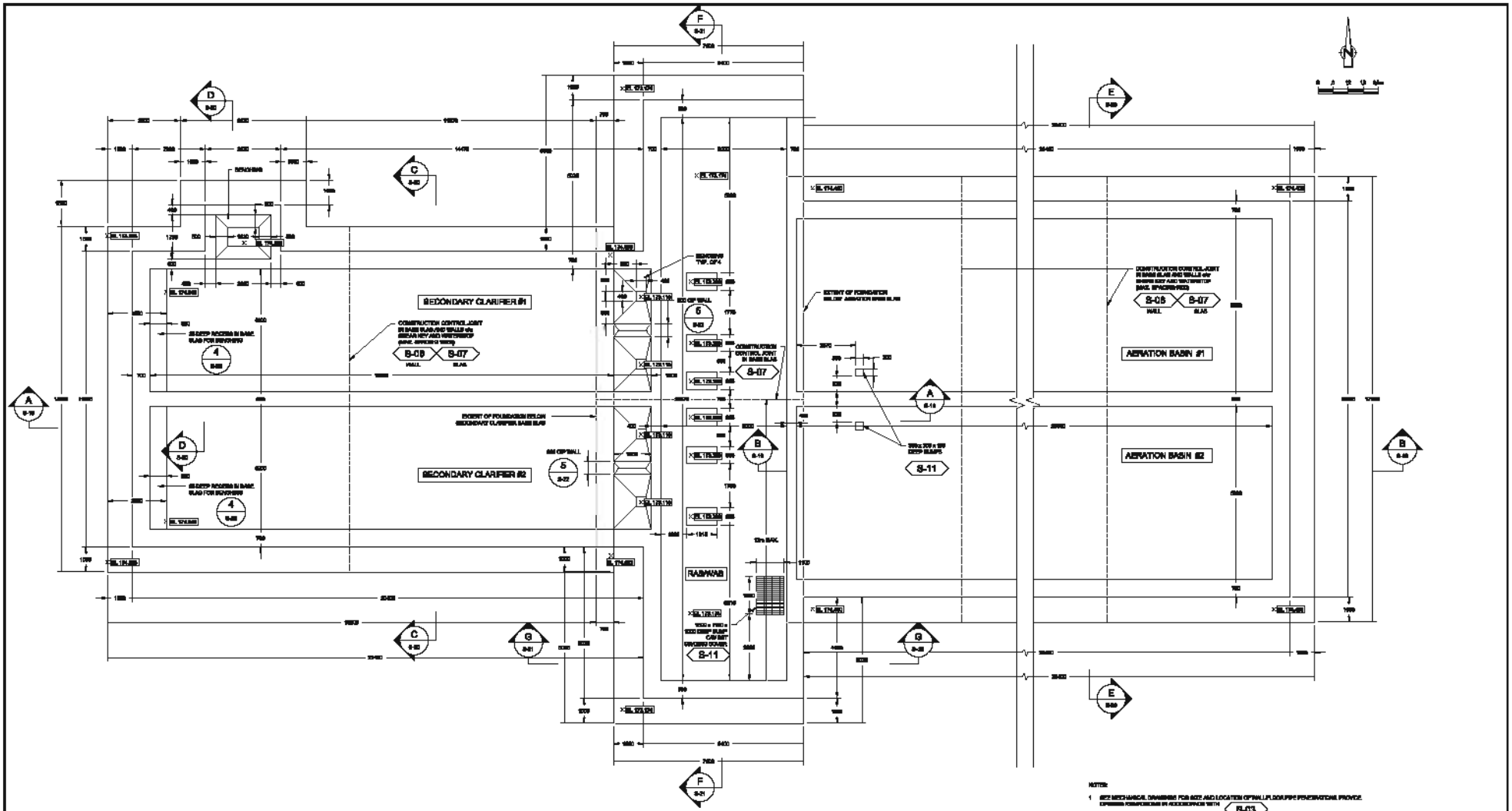
City of Anytown

ACME WWTP EXPANSION

STRUCTURAL NOTES

CONSULTING LTD.

Drawn:	Checked:	Designed:	Date: AUG 2020
Project Manager: AB	Reviewed By: DD	Designed By: EF	Drawn By: MH
Scale: NTS	Project No.: 53469-02	Report No.: 010	Drawing No.: S-01



PLAN - SECONDARY TREATMENT FOUNDATION

NOTES:

1. SEE MECHANICAL DRAWINGS FOR SIZE AND LOCATION OF WALL FLOOR PENETRATIONS. PROVIDE REINFORCEMENTS IN ACCORDANCE WITH S-03
2. CONFIRM SIZE, LOCATION AND REINFORCEMENT REQUIREMENTS OF ALL CONCRETE EQUIPMENT PADS WITH MECHANICAL DRAWINGS AND EQUIPMENT SUPPLIER.

ISSUED FOR MOE APPROVAL

No	Revision	Date	Initial

Approval

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City of Anytown

ACME WWTP EXPANSION

SECONDARY TREATMENT FOUNDATION PLAN

CONSULTING LTD.

Project Manager	Reviewed By	Designed By	Drawn By
AB	CD	EF	GH
Scale: 1:75	Project No: 53456-02	Report No: 010	Drawing No: S-17

PROCESS PIPE IDENTIFICATION

AC	ACID
AI	AIR, INSTRUMENT
ALP	AIR, LOW PRESSURE
AHP	AIR, HIGH PRESSURE
AB	AIR SCOUR
BD	BLOWDOWN
CDI	CONDENSATE DRAIN
CG	CHLORINE GAS
D	DESICANT
DDS	DEWATERED DIGESTED SLUDGE
DG	DIGESTER GAS
DR	DRAIN
DS	DIGESTED SLUDGE
EXH	EXHAUST
EW	EFFLUENT WATER
FC	FERRIC CHLORIDE
GW	GROUNDWATER
HP	HYDROGEN PEROXIDE
M	METHANOL
N	NUTRIENT
O	OXYGEN
OF	OVERFLOW
P	POLYMER
PW	POLISHED WATER
RAS	RETURN ACTIVATED SLUDGE
RW	RAW WATER
S	SUPERNATANT
SA	SAMPLE
SL	SLUDGE
SPD	SUMP PUMP DISCHARGE
TBS	THICKENED BOTTOM SLUDGE
TW	TREATED WATER
TWAS	THICKENED WASTE ACTIVATED SLUDGE
WAS	WASTE ACTIVATED SLUDGE
WW	WASH WATER
WI	SERVICE WATER, NON-POTABLE

PIPING DESIGNATION: 450 - CI,DI - RAS

- 450 - NOMINAL PIPE DIAMETER (mm)
- CI,DI - PIPE MATERIAL
- RAS - PIPE USE IDENTIFICATION LEGEND

VALVE SYMBOLS

- FOUR WAY VALVE
- AIR AND VACUUM VALVE
- ANGLE GATE VALVE
- ANGLE GLOBE VALVE
- GLOBE VALVE
- GATE VALVE
- KNIFE GATE VALVE
- BALL VALVE
- BUTTERFLY VALVE
- CHECK VALVE
- DIAPHRAGM VALVE
- NEEDLE VALVE
- PLUG VALVE
- ECCENTRIC PLUG VALVE
- PRESSURE REDUCING VALVE
- PINCH VALVE
- PRESSURE RELIEF VALVE
- SELF-CONTAINED PRESSURE REGULATOR
- VALVE WITH ACTUATOR
- SOLENOID VALVE OPERATOR
- FLOW INDICATOR
- TEMP. CONTROL VALVE
- CONTROL VALVE (FLOW DIRECTION VALVE SYMBOL)
- HOSE VALVE OR BIBB
- SAMPLE PORT
- FLUSH
- MULTIPORT BALL VALVE (BALL VALVE SHOWN.) ARROWS INDICATE PATTERN, SEAT PORTS ARE IMPLIED

LEVEL SENSOR SYMBOLS

- CAPACITANCE LEVEL SWITCH
- ULTRASONIC LEVEL TRANSMITTER
- FLOAT SWITCH

PIPE AND PIPE FITTING SYMBOLS

	SINGLE LINE	DOUBLE LINE
EXISTING PIPE		
NEW PIPE		
EXISTING PIPE TO BE ABANDONED		
EXISTING PIPE TO BE REMOVED		
WELDED JOINT		
GROOVED JOINT		
FLANGED JOINT		
MECHANICAL JOINT		
BELL AND SPIGOT JOINT (LEADED)		
HUB AND SPIGOT JOINT (RUBBER GASKET)		
BALL JOINT		
PVC JOINT		
GROOVED END ADAPTOR JOINT		
FLANGED COUPLING ADAPTOR		
FLANGED COUPLING ADAPTOR WITH THRUST TIES		
FLEXIBLE COUPLING		
FLEXIBLE COUPLING WITH THRUST TIES		
STEEL BELLOWS EXPANSION JOINT		
ELASTOMER BELLOWS EXPANSION JOINT		
ELBOW UP		
ELBOW DOWN		
TEE UP		
TEE DOWN		
LATERAL UP		
LATERAL DOWN		
CONCENTRIC REDUCER		
ECCENTRIC REDUCER		
UNION		
CAP		
ANCHOR		

PIPE AND PIPE FITTING SYMBOLS

	SINGLE LINE	DOUBLE LINE
ELBOW 90°		
CROSS		
TEE		
ELBOW 45°		
LATERAL		

MISCELLANEOUS PIPING SYMBOLS

- BACKFLOW PREVENTOR
- DIRECTION OF SLOPE
- DIRECTION OF FLOW
- INSULATED LINE
- INSULATED LINE w/STEAM TRACE
- INSULATED LINE w/ELECTRICAL TRACE
- LUBRICATOR, REGULATOR, FILTER

GATE SYMBOLS

EL VIEW	PLAN VIEW
	SLUICE
	BUTTERFLY
	FLAP
	SHEAR
	FABRICATED SLIDE

PIPE MATERIAL

CS	CARBON STEEL
CI	CAST IRON
CLDI	CEMENT LINED DUCTILE IRON
CPVC	CHLORINATED POLYVINYL CHLORIDE
CU	COPPER
DI	DUCTILE IRON
ELS	EPOXY LINED STEEL
FRP	FIBERGLASS REINFORCED PLASTIC
GALVS	GALVANIZED STEEL
GLDI	GLASS LINED DUCTILE IRON
HDPE	HIGH DENSITY POLYETHYLENE
PVC	POLYVINYL CHLORIDE
SST	STAINLESS STEEL

EQUIPMENT SYMBOLS

- SIGHT GLASS
- TRANSDUCER MOUNTING
- DISSOLVED OXYGEN ANALYZER
- INLINE MIXER
- INLINE CIRCULATING PUMP
- DIAPHRAGM PUMP
- CENTRIFUGAL PUMP OR BLOWER
- GEAR PUMP OR POSITIVE DISPLACEMENT BLOWER

HVAC SYMBOLS

- OPEN END DUCT
- ROOM THERMOSTAT
- ROOM THERMOSTAT w/GUARD
- SUPPLY AIR DUCT SECTION UP
- SUPPLY AIR DUCT SECTION DOWN
- RETURN/EXHAUST AIR DUCT SECTION UP
- RETURN/EXHAUST AIR DUCT SECTION DOWN
- FLEXIBLE CONNECTION
- TURNING VANES
- SUPPLY AIR DIFFUSER
- INSULATED DUCT
- OPPOSED BLADE DAMPER
- FIRE DAMPER
- BACKDRAFT DAMPER
- BALANCING DAMPER
- DAMPER MOTOR
- DOOR GRILLE
- UNIT HEATER

BUILDING SERVICES PIPE IDENTIFICATION

- HOT WATER
- HOT WATER RECIRCULATION
- COLD WATER
- CW (SOFT)
- SAN — SANITARY SEWER
- STM — STORM SEWER
- RWL — RAIN WATER LEADER
- V — VENT
- G — GAS
- F — FIRE STANDPIPE
- SPK — SPRINKLER
- HWS — HEATING WATER SUPPLY
- HWR — HEATING WATER RETURN
- CHWS — CHILLED WATER SUPPLY
- CHWR — CHILLED WATER RETURN
- LPS — LOW PRESSURE STEAM
- LPC — LOW STEAM CONDENSATE
- FT — FLOAT & THERMOSTATIC TRAP
- CWS — CONDENSER WATER SUPPLY
- CWR — CONDENSER WATER RETURN
- RD — ROOF DRAIN
- CO — CLEANOUT
- FD — FLOOR DRAIN
- HD — HUB DRAIN

GENERAL PIPING NOTES

1. SYMBOLS SHOWN HERE FOR SINGLE LINE FITTINGS ARE GENERIC ONLY. REFER TO PIPING SPECIFICATIONS FOR SPECIFIED END CONNECTIONS FOR SINGLE LINE PIPE AND FITTINGS.
2. SIZE OF FITTINGS SHOWN ON PLANS SHALL CORRESPOND TO ADJACENT STRAIGHT RUN OF PIPE, UNLESS NOTED OTHERWISE. TYPE OF JOINT AND FITTING MATERIAL SHALL BE THE SAME AS SHOWN FOR ADJACENT STRAIGHT RUN OF PIPE.
3. ALL FLEXIBLE CONNECTORS OR FLANGED ADAPTERS SHALL BE PROVIDED WITH THRUST TIES, BLOCKS, OR ANCHORS, UNLESS NOTED OTHERWISE. THRUST PROTECTION SHALL BE ADEQUATE FOR PRESSURES SPECIFIED.
4. NUMBER AND LOCATION OF UNIONS SHOWN ON DRAWINGS IS ONLY APPROXIMATE. PROVIDE ALL UNIONS NECESSARY TO FACILITATE CONVENIENT REMOVAL OF VALVES AND MECHANICAL EQUIPMENT.

ISSUED FOR MOE APPROVAL

No	Revision	Date	Initial

Approved

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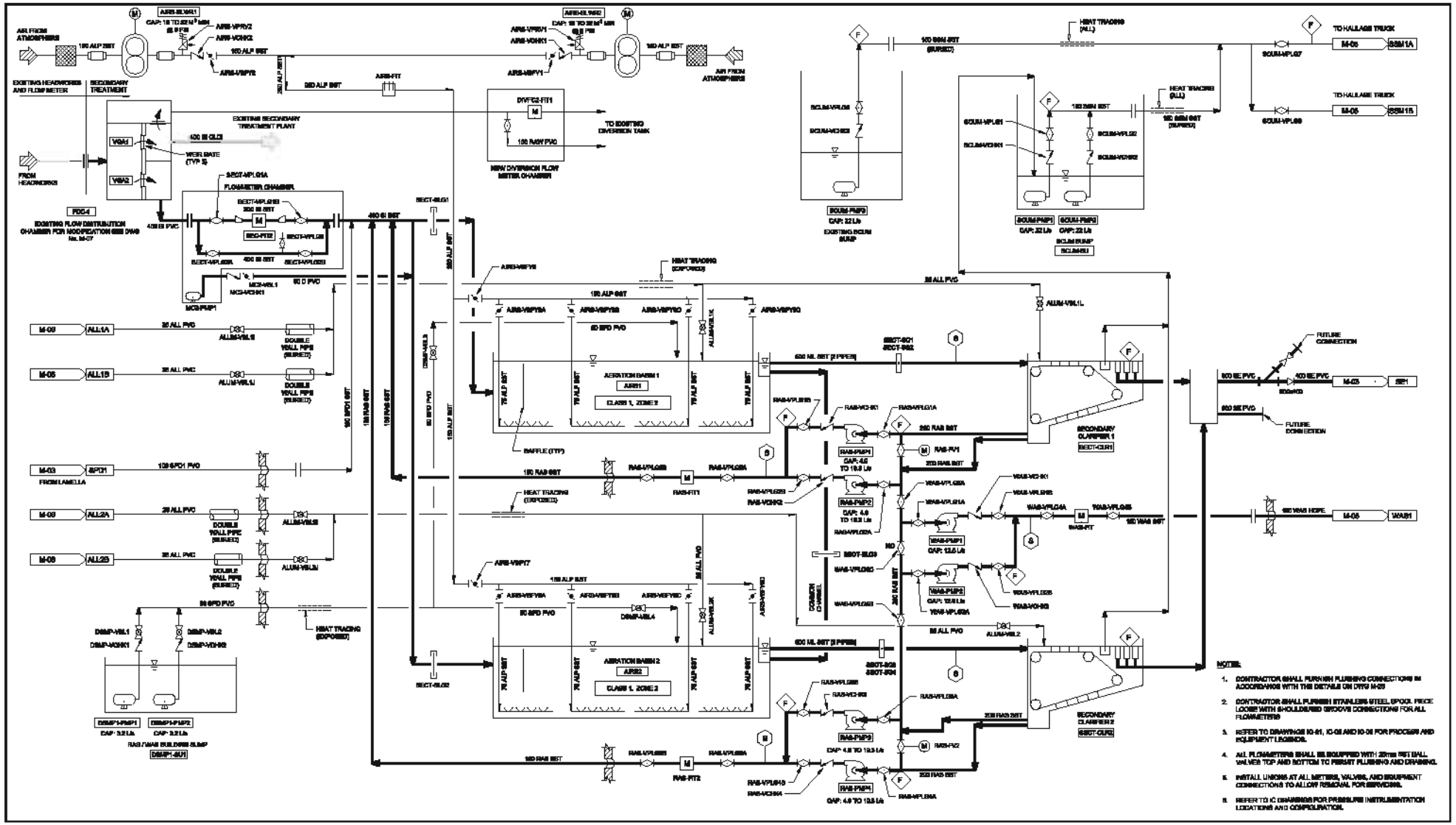
City of Anytown

ACME WWTP EXPANSION

MECHANICAL LEGEND

CONSULTING LTD.

Project Manager: AB	Reviewed By: CD	Designed By: EF	Drawn By: GH
Scale: NTS	Project No.: 53456-02	Report No.: 010	Drawing No.: M-01



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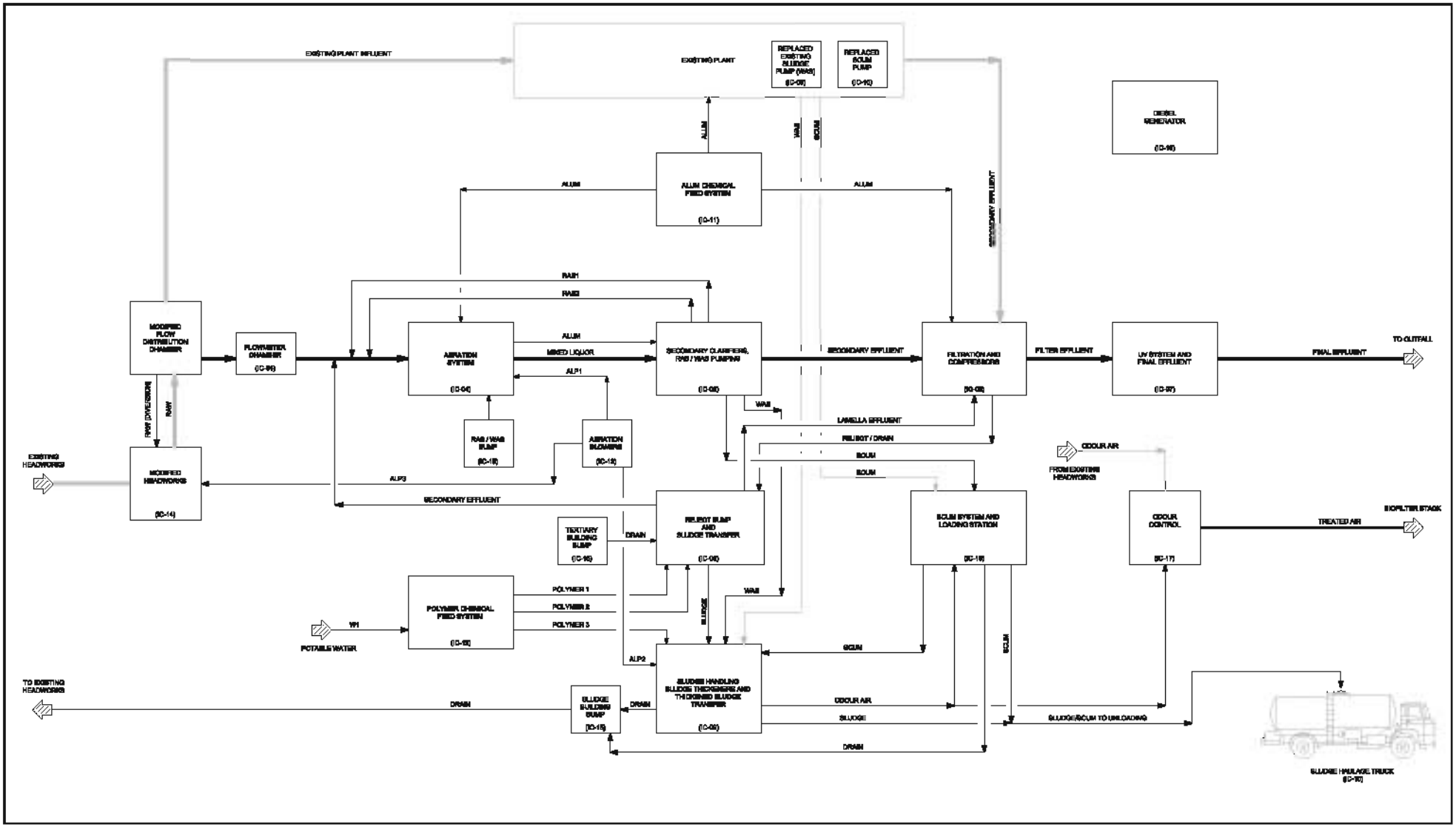
City of Anytown

ACME WWTP EXPANSION

NEW SECONDARY TREATMENT PROCESS FLOW DIAGRAM SHEET 1 OF 5

CONSULTING LTD.

Project Manager	Reviewed By	Designed By	Drawn By
AB	CD	EF	GH
Scale: NTS	Project No: 53456-02	Report No: 010	Drawing No: M-02



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Approval

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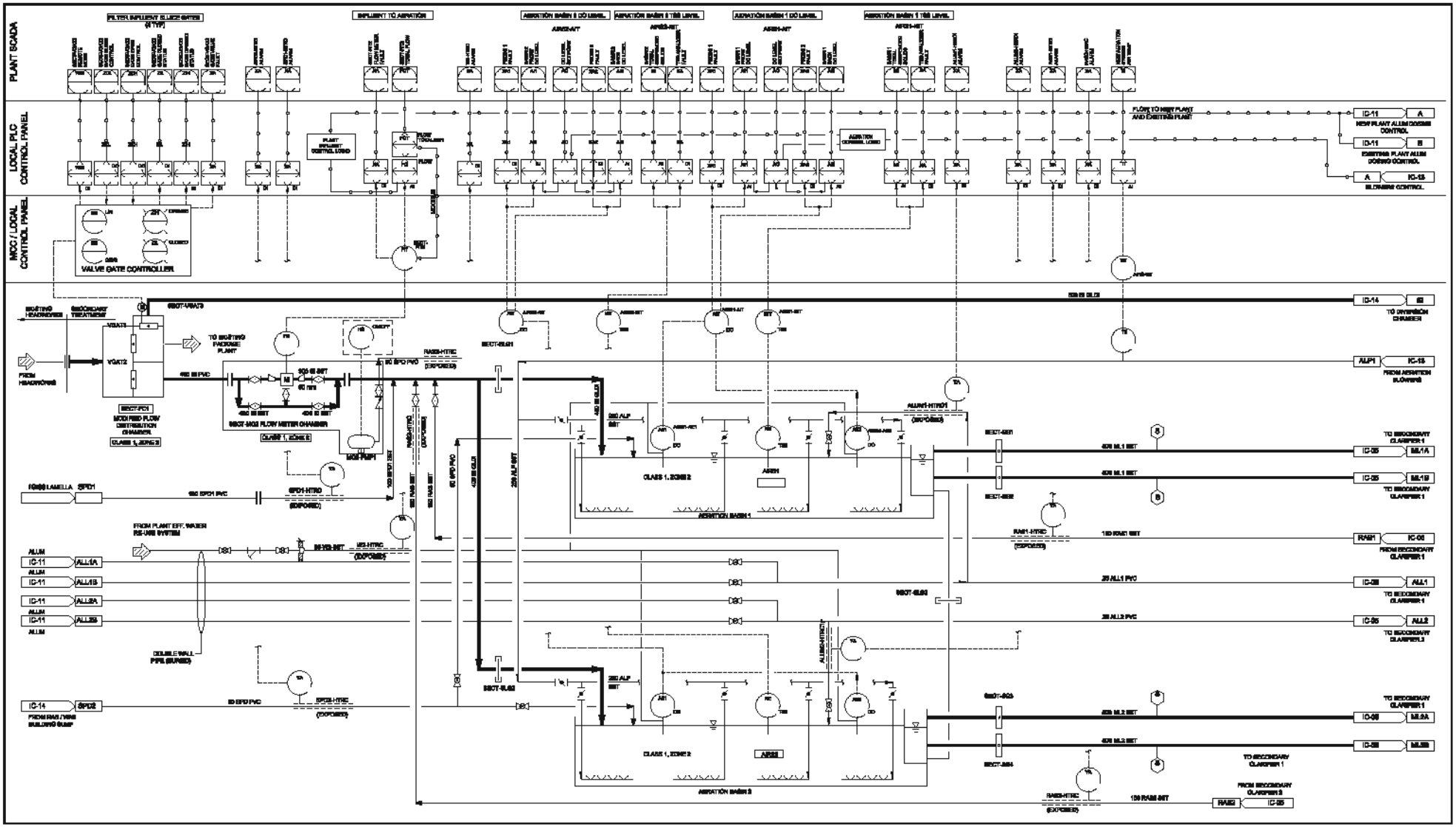
City of Anytown

ACME WWTP EXPANSION

P & ID OVERVIEW
BLOCK DIAGRAM

CONSULTING LTD.

Project Manager: AB	Reviewed By: BD	Designed By: EF	Drawn By: AH
Scale: NTS	Project No: 53456-02	Report No: 010	Drawing No: IC-00



ISSUED FOR MOE APPROVAL

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No	Revision	Date	Initial

Approval

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City of Anytown

ACME WWTP EXPANSION

NEW PLANT AERATION SYSTEM
P & ID

CONSULTING LTD.

Project Manager: AB	Reviewed By: DD	Designed By: EF	Drawn By: GH
Scale: NTS	Project No: 53456-02	Report No: 010	Drawing No: IC-04

ELECTRICAL LEGEND

GROUNDING SYMBOLS

- GROUND ROD
- GROUND CABLE CONNECTION AND GROUND STUB
- ROD ELECTRODE AND GROUND INSPECTION WELL
- ROD GROUNDING ELECTRODE
- CORNER SET GROUNDING ELECTRODES
- GROUND CABLE EMBEDDED OR BURIED, CABLE UP
- GROUND CABLE EXPOSED, CABLE DOWN
- GROUND CABLE CONNECTION TO EQUIPMENT
- GROUND CABLE CONNECTION TO BUILDING STEEL COLUMN

CIRCUIT SYMBOLS

- RECTIFIER BRIDGE
- RESISTOR
- TIME DELAY CAPSULE N/O — 15 SECS.
- TIME DELAY CAPSULE N/C — 10 SECS. — * ENTER TIME DELAY RESULT (e.g. 10 SECS.)
- NORMALLY OPEN RELAY CONTACT
- NORMALLY CLOSED RELAY CONTACT
- RELAY COIL
- METER — CTR=COUNTER; AM=AMMETER; VM=VOLTMETER; WHM=WHT (HOURMETER)
- TRANSFORMER — T1
- PILOT LIGHT (LENS COLOUR)
- POLARIZED CAPACITOR
- FIXED CAPACITOR
- LIGHT EMITTING DIODE
- ZENER DIODE
- DIODE
- ARC SUPPRESSOR
- FUSE — 5A
- BATTERY
- TERMINAL WITH DESIGNATION — 1A
- GROUND
- BREAKER STAR
- THERMAL OVERLOAD
- MOTOR OVERLOAD
- MAGNETIC OVERLOAD
- CIRCUIT BREAKER
- MOTOR — M
- MOTOR — 600A
- WIRE LABELING — XX, XX, XX

SWITCH SYMBOLS

- LIMIT SWITCH N/O
- LIMIT SWITCH N/C
- TIME DELAY N/O DELAY ON CLOSING
- TIME DELAY N/C DELAY ON OPENING
- TIME DELAY N/C DELAY ON CLOSING
- TIME DELAY N/O DELAY ON OPENING
- TIME DELAY COIL
- PROXIMITY LIMIT SWITCH N/O
- PROXIMITY LIMIT SWITCH N/C
- FOOT OPERATED L/S CLOSED
- FOOT OPERATED L/S OPEN
- FLOW OPERATED L/S CLOSED
- FLOW OPERATED L/S OPEN
- FLOAT OPERATED L/S CLOSED
- FLOAT OPERATED L/S OPEN
- PRESSURE OPERATED L/S CLOSED
- PRESSURE OPERATED L/S OPEN
- TEMPERATURE OPERATED L/S CLOSED
- TEMPERATURE OPERATED L/S OPEN
- 2 POSITION SELECTOR SWITCH
- 3 POSITION SELECTOR SWITCH
- SOLENOID
- PUSH BUTTON CLOSED
- PUSH BUTTON OPEN
- DISCONNECT SWITCH N/O
- MAINTAINED EMERGENCY STOP
- HAND-OFF AUTO SELECTOR SWITCH — H, B, A, P1, P2, S1, S2

LAYOUT SYMBOLS

- PHOTOCELL EMITTER
- PHOTOCELL RECEIVER
- HORN
- BUZZER
- BELL
- SENSING ELEMENT
- PILOT LIGHT C/W TEST SWITCH (LENS COLOUR)
- SWITCH SINGLE POLE 120V
- SWITCH DOUBLE POLE 120V
- SWITCH THREE WAY 120V
- DUPLEX RECEPTACLE 120V, 15A;
- DUPLEX RECEPTACLE WITH GROUND FAULT PROTECTION, 120V, 15A — GF
- DUPLEX RECEPTACLE WEATHER PROOF, 120V, 15A — WP
- TWIST LOCK RECEPTACLE 120V — TW
- THERMOSTAT — T
- 60W, RATING REQUIRED, 24" DIAMETER ELECTRIC UNIT HEATER, C/W CEILING MOUNTED BRACKETS — 60W/L
- MOTORIZED DOOR OPERATION
- POWER TRANSFORMER - T1
- WELDING RECEPTACLE
- TELEPHONE OUTLET MOUNTED 12" ABOVE FINISHED FLOOR LEVEL
- TELEPHONE OUTLET MOUNTED 4'-6" ABOVE FINISHED FLOOR LEVEL
- 3 PHASE, MANUAL MOTOR STARTER
- THREE PHASE MANUAL MOTOR STARTER/OVERLOAD SWITCH
- START-STOP PUSHBUTTON AND PILOT LIGHT
- LOCKABLE DISCONNECT SWITCH
- FIRE ALARM PULL STATION MOUNTED 4'-6" ABOVE FINISHED FLOOR LEVEL
- PHOTO ELECTRIC SMOKE DETECTOR — P, E
- SPRINKLER FLOW ALARM SWITCH CONNECTED TO FIRE ALARM SYSTEM
- SOLENOID VALVE CONNECTED TO FIRE ALARM SYSTEM
- 110V, DUPLEX RECEPTACLE; GFI = GROUND FAULT CIRCUIT INTERRUPTER; WP = WEATHERPROOF — GFI, WP
- DATA GRADE TELEPHONE OUTLET — D
- LOCAL CONTROL STATION — S, B, S
- HEAT DETECTOR — H
- FIRE BELL — F
- FIRE ALARM STROBE — S
- FIRE ALARM INTEGRATED BELL AND LIGHT UNIT

LIGHTING SYMBOLS

- STROBE LIGHT - TYPE S — S
- LIGHTING FIXTURE - TYPE A — A
- FLUORESCENT LIGHTING FIXTURE - TYPE F — F
- LIGHTING FIXTURE WALL MOUNTED TYPE A — A
- EXIT LIGHT AND CEILING MOUNTED OUTLET BOX. DIRECTIONAL ARROWS AS INDICATED. ENGRAVED ARIAL6 DIRECTIONAL PANEL
- Electrovoice BATTERY PACK WITH CHARGER AND SEALED BEAM HEADS
- Electrovoice BATTERY PACK WITH CHARGER, EXIT LIGHT AND SEALED BEAM HEADS — E
- EMERGENCY LIGHTING REMOTE HEAD — E
- EXIT LIGHT - WALL MOUNTED
- FIRE ALARM PANEL
- LIGHTING DISTRIBUTION PANEL 208Y/120V, 3Ø, 4W - PANEL ID NUMBER AS SHOWN — DPWH
- DISTRIBUTION PANEL 240Y/139V, 1Ø, 3W - PANEL ID NUMBER AS SHOWN — DPWH

NOTES:

1. THIS IS A STANDARD LEGEND LIST, THEREFORE SOME SYMBOLS OR ABBREVIATIONS MAY APPEAR ON THIS LIST AND NOT ON THE DRAWINGS.
2. CONTACT ENGINEER FOR ABBREVIATIONS AND SYMBOLS NOT LISTED.
3. LIGHTING TYPES AND DETAILS ON E-03. SEE SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.

ISSUED FOR MOE APPROVAL

SCALE VERIFICATION: THIS BAR MEASURED 50mm ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

No	Revision	Date	Initial

Approval

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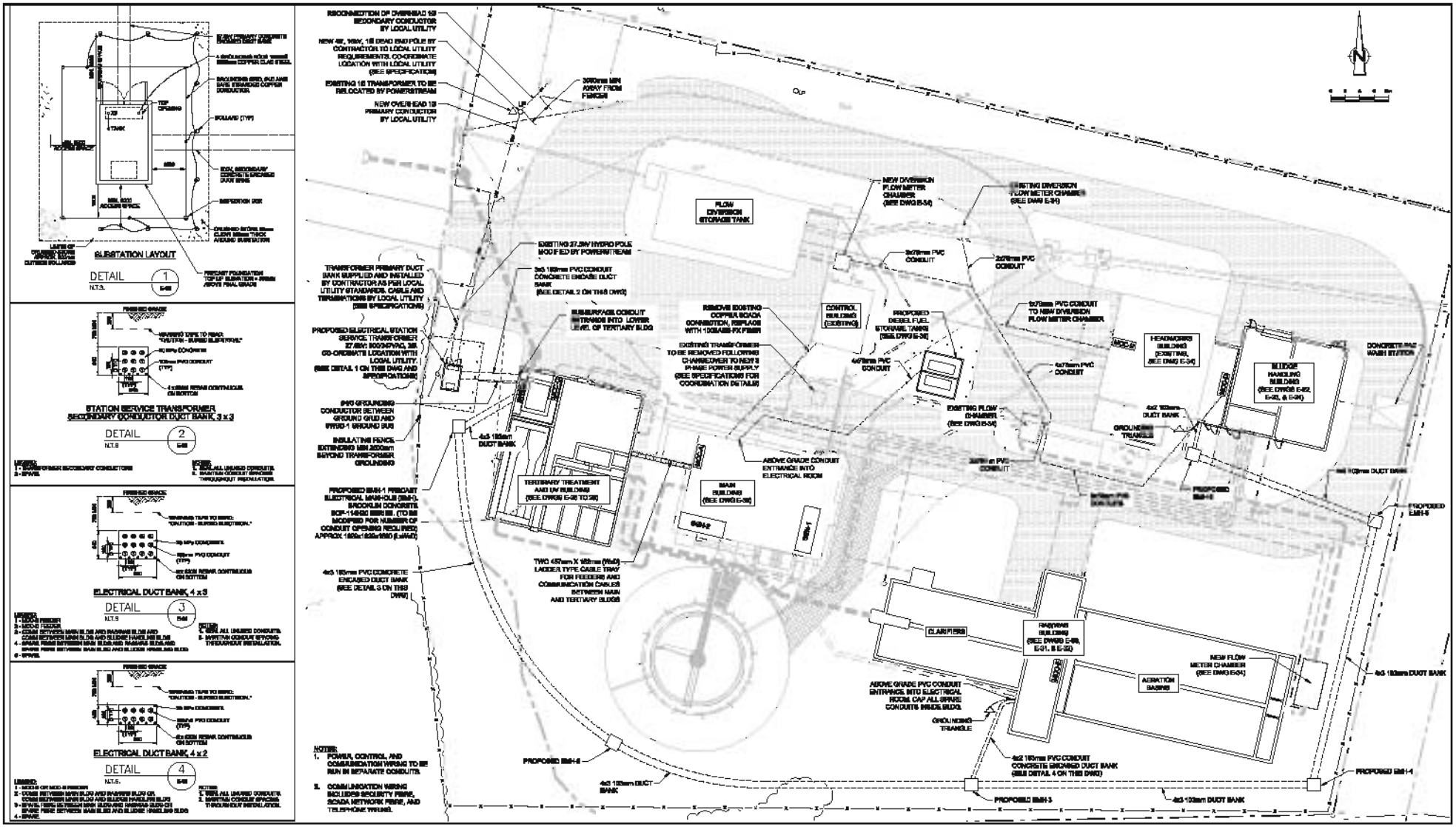
City of Anytown

ACME WWTP EXPANSION

ELECTRICAL LEGEND

CONSULTING LTD.

Project Manager	Reviewed By	Designed By	Drawn By
AB	BD	EF	AH
Scale: NTS	Project No: 53456-02	Report No: 010	Drawing No: E-01



ISSUED FOR MOE APPROVAL

No.	Revision	Date	Initial

PLACE PENGSTAMP HERE

City of Anytown

ACME WWTP EXPANSION

ELECTRICAL SITE PLAN

CONSULTING LTD.

Project Manager	Reviewed By	Designed By	Drawn By
AB	DD	EF	BH
Scale: 1:200	Project No: 53469-02	Report No: 010	Drawing No: E-02

PROJECT SPECIFICATIONS

SPECIFICATIONS LIST

DIVISION 1

01000	GENERAL REQUIREMENTS
01010	SUMMARY OF WORK
01025	MEASUREMENT AND PAYMENT
01035	AMENDING AND SUPPLEMENTING CONTRACT DOCUMENTS
01040	COORDINATION
01060	REGULATORY REQUIREMENTS
01092	ABBREVIATIONS
01200	PROJECT MEETINGS
01200A	SAMPLE PRE-CONSTRUCTION MEETING AGENDA
01250	SUBSTITUTIONS
01300	SUBMITTALS
01310	PROGRESS SCHEDULES
01351	HEALTH AND SAFETY
01400	QUALITY CONTROL
01420	REFERENCES
01430	OPERATION AND MAINTENANCE DATA
01450	RECORD DRAWINGS
01500	CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS
01501	CONSTRUCTION SEQUENCING
01561	ENVIRONMENTAL PROTECTION
01600	MATERIAL AND EQUIPMENT
01640	MANUFACTURERS' SERVICES
01662	FACILITY COMMISSIONING
01720	PREPARATION
01740	CLEANING
01750	TESTING OF PIPING
01760	WARRANTY WORK
01770	CLOSEOUT PROCEDURES
01780	CONTRACT CLOSEOUT
01810	EQUIPMENT TESTING AND FACILITY STARTUP
01820	DEMONSTRATION AND TRAINING

DIVISION 2

02140	DEWATERING
02150	EXCAVATION SHORING SYSTEMS
02200	SITE PREPARATION
02315	EXCAVATION, TRENCHING AND BACKFILLING
02362	DUST CONTROL
02389	PRESERVATION OF WATER COURSES
02631	MANHOLES AND CATCHBASINS
02701	AGGREGATES - GENERAL

02721	GRANULAR BASE
02723	GRANULAR SUB-BASE
02821	CHAIN LINK FENCE AND GATES
02911	TOPSOIL AND FINISH GRADING
02934	TERRASEEDING

DIVISION 3

03100	CONCRETE FORMS AND ACCESSORIES
03200	CONCRETE REINFORCEMENT
03300	CAST-IN-PLACE CONCRETE
03345	CONCRETE CURING AND FINISHING
03410	PLANT PRECAST STRUCTURAL CONCRETE

DIVISION 4

04051	MASONRY PROCEDURES
04060	MORTAR AND MASONRY GROUT
04080	MASONRY REINFORCEMENT AND CONNECTORS
04090	MASONRY ACCESSORIES
04211	BRICK MASONRY
04220	CONCRETE MASONRY UNITS

DIVISION 5

05500	METAL FABRICATIONS - GENERAL
05502	METAL FABRICATIONS - STRUCTURAL
05510	METAL STAIRS
05512	STAINLESS STEEL HANDRAILS

DIVISION 6

06100	ROUGH CARPENTRY
06192	PREFABRICATED WOOD TRUSSES

DIVISION 7

07200	INSULATION
07610	SHEET METAL ROOFING
07620	SHEET METAL FLASHING
07900	JOINT SEALERS

DIVISION 8

08110	STEEL DOORS AND FRAMES

08331 OVERHEAD COILING DOORS
08520 WINDOWS
08710 DOOR HARDWARE
08800 GLAZING

DIVISION 9

09900 PAINTING AND PROTECTIVE COATINGS

DIVISION 10

10200 LOUVRES AND VENTS
10420 FIRE EXTINGUISHERS AND SAFETY EQUIPMENT

DIVISION 11

11010 EQUIPMENT GENERAL REQUIREMENTS
11206 CONTINUOUS BACKWASH SAND FILTRATION SYSTEM
11245 TABLET CHLORINATION SYSTEM
11280 FABRICATED SLUICE GATES
11282 FABRICATED SLIDE GATES AND STOP LOGS
11290 TELESCOPING DECANTER VALVES
11300 OPEN TOP TANK MIXED
11347 ULTRAVIOLET DISINFECTION EQUIPMENT
11376 ROTARY POSITIVE DISPLACEMENT BLOWERS
11377 COARSE BUBBLE AIR DIFFUSERS
11378 FINE BUBBLE AIR DIFFUSERS
11383 COMPRESSED AIR SYSTEM
11421 HORIZONTAL SPLIT CASE PUMPS
11427 POSITIVE DISPLACEMENT PUMPS
11441 SUBMERSIBLE SEWAGE PUMPS
11442 VARIABLE SPEED PACKAGED PUMPING SYSTEM
11540 LIQUID CHEMICAL FEED SYSTEMS
11545 POLYMER SOLUTION SYSTEM
11581 IN-VESSEL BIOLOGICAL ODOUR CONTROL SYSTEM
11610 RECTANGULAR CLARIFIER SLUDGE COLLECTION SYSTEM
11615 SCUM COLLECTOR SYSTEM
11710 FIBERGLASS REINFORCED PLASTIC TANKS
11720 STEEL TANKS
11900 ABOVEGROUND FUEL OIL STORAGE TANKS
11905 FUEL OIL SYSTEM

DIVISION 13

13010 PROCESS - CONTROL GENERAL
13105 GENERAL INSTRUMENTATION REQUIREMENTS
13110 ULTRASONIC LEVEL TRANSMITTER

13120	MAGNETIC FLOW METERS
13121	THERMAL MASS FLOW METERS
13130	FLOAT SWITCH
13140	PRESSURE TRANSMITTER
13160	TEMPERATURE TRANSMITTER
13161	TEMPERATURE SWITCH
13170	SLUDGE BLANKET ANALYZER
13178	TOTAL SUSPENDED SOLIDS METER
13180	TURBIDITY ANALYZER
13182	DISSOLVED OXYGEN ANALYZER
13190	COMBUSTIBLE GAS DETECTOR
13305	FIELD WIRING
13310	PANEL SPECIFICATIONS
13400	REMOTE PROCESSING UNITS
13480	SCADA SYSTEM INTEGRATOR
13510	PCS SCADA LOCAL AREA NETWORK
13710	SECURITY SYSTEM - ELECTRONIC ACCESS CONTROL
13921	FACTORY ACCEPTANCE TEST
13930	INSTRUMENT AND EQUIPMENT TESTING
13933	SITE ACCEPTANCE TEST

DIVISION 14

14620	HOIST, MONORAIL AND LIFTING DAVIT SYSTEMS
14620-01	HOIST/MONORAIL DATA SHEET, HOIST, AND MONORAIL

DIVISION 15

15010	MECHANICAL GENERAL REQUIREMENTS
15080	PROCESS PIPING INSULATION
15100	PLUMBING PIPING
15200	PROCESS PIPING AND FITTINGS
15200-02	CARBON STEEL PIPE AND FITTINGS - SPECIAL SERVICE
15200-08	STAINLESS STEEL PIPE AND FITTINGS - GENERAL SERVICE
15200-11	POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS
15200-14	COPPER AND COPPER ALLOY PIPE, TUBING AND FITTINGS
15200-15	HDPE PIPE AND FITTINGS
15200-16	DOUBLE WALL CONTIANMENT PIPING
15200-20	STAINLESS STEEL PIPE AND FITTINGS - SCUM SERVICE
15201	PIPING SUPPORT SYSTEMS
15204	PROCESS PIPING SPECIALISTS
15205	PROCESS VALVES AND OPERATORS
15410	PLUMBING FIXTURES
15440	PLUMBING EQUIPMENT
15730	UNITARY AIR CONDITIONING EQUIPMENT
15760	TERMINAL HEAT TRANSFER UNITS
15810	METAL DUCTWORK AND ACCESSORIES
15830	FANS
15950	HVAC SYSTMES TESTING, ADJUSTING AND BALANCING

15955 PIPING LEAKAGE TESTING

DIVISION 16

16010 ELECTRICAL GENERAL REQUIREMENTS
16015 ELECTRICAL SYSTEMS ANALYSIS
16031 INSPECTION AND TESTING
16050 BASIC MATERIALS AND METHODS
16051 INSTALLATION OF CABLES IN TRENCHES AND DUCTS
16120 WIRING SYSTEMS
16131 SPLITTERS, JUNCTION, PULL BOXES AND CABINETS
16132 CABLE TRAYS
16133 CONDUITS, CONDUIT FASTENINGS AND CONDUIT FITTINGS
16139 ELECTRICAL DUCT BANKS
16210 ELECTRICAL UTILITY SERVICES
16222 MOTORS: 1 TO 200 KW, 575 V
16223 MOTOR STARTERS TO 600 V
16224 VARIABLE FREQUENCY DRIVES TO 600 V
16225 MOTOR CONTROL CENTRE
16231 DIESEL ELECTRIC GENERATING UNITS (LIQUID COOLED)
16233 DIESEL ELECTRIC GENERATING UNITS FACTORY TEST RESULTS
16234 DIESEL ELECTRIC GENERATING UNITS INFORMATION FORM
16403 LV SERVICE ENTRANCE SWITCHBOARD
16414 DISCONNECT SWITCHES - FUSED AND UNFUSED
16450 GROUNDING - SECONDARY
16505 LIGHTING EQUIPMENT
16857 ELECTRIC HEAT TRACING

ATTACHMENT 11

PIPE DATA FORM

Ministry of the Environment

Ministère de l'Environnement

Ontario

PIPE DATA FORM

WATERMAIN, STORM SEWER, SANITARY SEWER, AND FORCEMAIN DESIGN

SUPPLEMENT TO APPLICATION FOR APPROVAL FOR WATER AND SEWAGE WORKS

General:

Information requested in this form is collected under the authority of the *Ontario Water Resources Act* (OWRA), the *Safe Drinking Water Act* (SDWA), the Drinking-Water Systems Regulation (O. Reg. 170.03) and the *Environmental Bill of Rights* (EBR). This information will be used to evaluate applications for approval of municipal and private sewage works as required by section 53 of the OWRA and to evaluate applications for approval of municipal and non-municipal drinking-water systems as required by sections 31, 36, 38, 52 and 60 of the SDWA.

Instructions:

1. This form should accompany all applications for a Water and Sewage Works. It does not replace the application form for a Certificate of Approval and is required in addition to the supporting technical information described in the Guide for Applying for Municipal and Private Water and Sewage Works. All designs are expected to be in accordance with MOE design guidelines and the 10 State Standards, as updated from time to time.

2. The information contained in this form and the required supporting stamped engineering drawings are the minimum information requirements used to process the application for a Certificate of Approval. All sections MUST be filled out and incomplete forms will be RETURNED to the applicant.

3. Application forms and supporting documentation are available from the Environmental Assessment and Approvals Branch toll free at 1-800-461-6290 (locally at 416-314-8001), from your local District Office of the Ministry of the Environment, and in the "Publications" section of the Ministry of the Environment website at www.ene.gov.on.ca.

4. Questions regarding completion and submission of this data form should be directed to the Environmental Assessment and Approvals Branch, 2 St. Clair Avenue West, Floor 12A, Toronto, Ontario, M4V 1L5, 1-800-461-6290 or (416) 314-8001, or to your local District Office of the Ministry of the Environment.

INFORMATION FOR PROPONENTS APPLYING FOR A CERTIFICATE OF APPROVAL FOR WATER AND SEWAGE WORKS

Section 53 of the *Ontario Water Resources Act* and Part V of the Safe *Drinking Water Act* require that anyone who establishes, alters, extends or replaces new or existing water or sewage works shall do so only in accordance with approval granted by the Director. As a result, any plans to change watermains, storm sewers, sanitary sewers, or combined sewers must first be granted a Certificate of Approval (works which are exempt from Certificate of Approval requirements are detailed in Ontario Regulation 525/98). Detailed information on approval requirements and procedures is contained in separate documents entitled "Guide for Applying for Approval of Municipal and Private Water and Sewage Works (Section 53 *Ontario Water Resources Act*)" and "Guide For Applying For Approvals Related To Municipal And Non-Municipal Drinking-Water-Systems – Parts V and VI of the *Safe Drinking Water Act* and Drinking-Water Systems Regulation". These documents are available on the Ministry of the Environment's website (www.ene.gov.on.ca) or can be obtained by contacting a client services representative at (413) 314-8001.

CRITERIA FOR APPROVAL – WATER AND SEWAGE WORKS

The anticipated environmental impacts of water and sewage works are land and water contamination, or overflow causing physical damage, or resulting in adverse effect. Generally, these impacts can be minimized by appropriate design, installation, operation and maintenance of the water and sewage pipes. There are a number of assessment criteria, which will be explained in this data form, and which can be read in greater detail in the following guidelines, as updated from time to time:

- Guidelines for the design of water distribution systems, Ministry of the Environment, 1985
- Guidelines for the design of sanitary sewage systems, Ministry of the Environment, 1985
- Interim guidelines for the design of storm sewer systems, Ministry of the Environment, 1985
- Procedure for the Determination of Treatment Requirements for Municipal and Private Combined and Partially Separated Sewer Systems (Procedure F-5-5)
- Procedures to govern separation of sewers and watermains (Procedure F-6-1)

1.0 GENERAL PROJECT INFORMATION

1.1 Site Name: Boulevard Road Pumping Station (PS)

1.2 Municipality: City of Anytown

Client (if different from Municipality) _____

1.3 Type of Works Project (please check all that apply)

- ☐ Watermain — *Please complete Sections 1.0 to 5.0 of this form*
- ☐ Storm Sewer — *Please complete Sections 1.0 to 4.0, 6.0 and Appendix A of this form*
- ☐ Sanitary Sewer — *Please complete Sections 1.0 to 4.0, 7.0 and Appendix B of this form*
- ☒ Forcemain — *Please complete Sections 1.0 to 4.0, 8.0 and Appendix C of this form*

1.4 (a) Project Purpose (please check all that apply)

☐ Replacement ☒ Increased demand ☐ Connecting existing lines ☐ New development

☐ Other: _____

2.0 ENVIRONMENTAL ASSESSMENT ACT REQUIREMENTS

2.1 Is this a private sector project?

☐ Yes ☒ No

If 'No' and not an MEA Class EA Schedule C Residential underdaking, please complete 2.2 and 2.3.

2.2 (a) Choose applicable Municipal sector Class EA Schedule

☒ Schedule A ☐ Schedule B ☐ Schedule C

(b) From the appropriate Schedule identified in 2.2(a), please identify Project Type and associated Schedule/Paragraph No. which applies to the proposed project

☐ Water Project ☒ Wastewater Project Schedule No. A-2

For 'Schedule B' please complete 2.3(a),(b) *For 'Schedule C', please complete 2.3(a),(b),(c)*

2.3 (a) Has a Notice of Completion been submitted along with this application?

☐ Yes ☐ No

(b) Were any Part II Orders (ie. "Bump-up" requests) received for this project?

☐ Yes ☐ No

If 'Yes', please provide details: _____

(c) Has an Environmental Study Report (ESR) been completed?

☐ Yes ☐ No

If 'Yes', please include ESR Cover page with this submission

3.0 DRAWINGS

NOTE: All drawings must include an accurate scale and be stamped by a Professional engineer. If the drawing is of a large scale where small separation distances cannot be easily measured, these distances must be marked on the drawing or noted as a typical separation.

Have the following details been included with this submission?

- [x] *Site Plan, including*
  - [x] Proposed works
  - [x] Existing works (as appropriate)
  - [ ] Property lines/Municipal boundaries
  - [ ] Any water bodies in proximity to the works
- [x] *Plan and Profile of all Pipes*
  - [ ] Horizontal distance between watermains and sewers
  - [ ] Vertical distance between watermains and sewers
  - [x] Length, diameter and slope of each pipe segment
  - [x] Locations of valves, valve chambers if > 300mm diametre, pressure reducers, tees, etc
  - [ ] Location of manholes (and their respective IDs)
- [ ] *Storm Drainage Area*
  - [ ] Indicate all areas which drain into the proposed works
  - [ ] Physical area in hectares
  - [ ] Runoff Coefficient for each drainage area
  - [ ] Storm water drainage path
- [x] *Sanitary Drainage Area*
  - [x] Indicate all areas which drain into the proposed works
  - [x] Physical area in hectares
  - [ ] Population for each drainage area
  - [ ] Sanitary Sewer drainage path
- [x] *Other Details*
  - [ ] Typical separations, where not easily measured from pipe drawings
  - [x] Appertunances
  - [ ] Municipal drains

4.0 ADDITIONAL INFORMATION

4.1 Are the proposed works laid below the frost penetration depth for the area at all points?

[x] Yes [ ] No

4.2 (a) Are all existing and proposed watermains separated by at least 2.5 m of clear horizontal distance from all existing and proposed sewers and storm water conveyance systems (ie. ditches)?

[x] Yes [ ] No

(b) Are all existing and proposed watermains separated by at least 0.5 m of clear vertical distance higher than all existing and proposed sewers and storm water conveyance systems (ie. ditches)?

[x] Yes [ ] No

(c) Are all existing and proposed sewers, including all drains and similar sources of contamination, separated by at least 15 metres from potable water reservoirs below normal ground surface and well supplies?

[x] Yes [ ] No

If 'No' to any part of Question 4.0, please refer to Procedure F-6-1 for solutions to prevent contamination when separation distances cannot be met

5.0 WATERMAINS

For Questions 5.1 to 5.3, please attach an additional sheet if necessary

5.1 Description of Proposed Watermain(s) (including service area/development)

5.2 Description of Existing Works (in proximity to proposed works)

5.3 For each watermain, please provide the following details in the chart below (or equivalent)

STREET	FROM (street/manhole)	TO (street/manhole)	DIAMETER (mm)	ROUGHNESS

5.4 Are all of the watermains a minimum of 150 mm in diameter?

☐ Yes ☐ No

5.5 What is the expected operating pressure range for this watermain under maximum day demand?

_____ to _____ *(please indicate units)*

5.6 (a) Will the watermain pressure drop below 275 kPa (40 psi)?

☐ Yes ☐ No

If 'Yes', please provide an explanation for this situation and future plans to address the problem:

(b) Is there sufficient pressure (138 kPA or 20 psi) reserved for fire flow/protection?

☐ Yes ☐ No

5.7 If this is a feedermain or a pipe dedicated to transporting potable water only (ie. having no service connections), have hydraulic transients been considered?

☐ Yes ☐ No

If 'Yes', please describe the results:

5.8 (a) Are there any dead end points in the system?

☐ Yes ☐ No *If 'Yes', then please complete 5.8(b)*

(b) How will water stagnation be addressed?

☐ Fire Hydrants ☐ Blow-off point ☐ Other _____

5.9 (a) Are there any tee- or cross-connections?

☐ Yes ☐ No *If 'Yes', then please complete 5.9(b)*

(b) Are there at least two (2) shut-off valves at each tee-connection, and at least three (3) shut-off valves at each cross-connection?

☐ Yes ☐ No

If 'No', how will disruptions to the system be minimized during repairs or emergencies?

6.0 STORM SEWERS

For Questions 6.1 to 6.3, please attach an additional sheet if necessary

6.1 Description of Proposed Storm Sewer(s) (including service area/development)

6.2 Is this application for approval a part of a larger and/or phased development?

☐ Yes ☐ No

If 'Yes', please provide full details on any existing developments including all Certificates of Approval that have been approved or application that are currently under review. Clearly indicate in all stamped engineering drawings and reports which developments belong to which phase and whether they are existing, for current development, or for future development.

(please attach another sheet if necessary)

6.3 Description of Existing Works (in proximity to proposed works)

6.4 For each storm sewer, please provide the following details in the chart below (or equivalent)

STREET	FROM (street/manhole)	TO (street/manhole)	DIAMETER (mm)	ROUGHNESS

6.5 Has the Storm Sewer Hydraulic Design Sheet (or equivalent) been included with this submission? (refer to the Guidance Document in Appendix A)

☐ Yes ☐ No

6.6 Please indicate which land use surface types are included in the drainage area and list the runoff coefficient(s) used for each type

SURFACE TYPE	RECOMMENDED	USED
☐ Asphalt, concrete, roof areas	0.90 - 1.00	
☐ Gravel	0.80 - 0.85	
☐ Grassed areas, parkland	0.15 - 0.35	
☐ Commercial	0.75 - 0.85	
☐ Industrial	0.65 - 0.75	
☐ Single family dwelling	0.40 - 0.45	
☐ Semidetached	0.45 - 0.60	
☐ Row housing, Townhousing	0.50 - 0.70	
☐ Apartments	0.60 - 0.75	
☐ Institutional	0.40 - 0.75	
☐ Other		

If **USED** *runoff coefficient does not fall within the* **RECOMMENDED** *range, please provide rationale below:*

6.7 (a) What is the full flow velocity range for all storm sewers in the proposed works?

_____ to _____ m/s

(b) If the full flow velocity is outside of the range of 0.8 m/s to 6.0 m/s, what measures will be employed to reduce sediment build up and/or erosion in the pipe?

_____

_____

6.8 (a) What is the municipality's requirement for the minor design storm event?

☐ 2 year ☐ 5 year ☐ 10 year ☐ Other _____

(b) What storm event has been used for the design of the proposed works?

☐ 2 year ☐ 5 year ☐ 10 year ☐ Other _____

(c) Are there any inlet control devices (ICDs) proposed in the catch basins?

☐ Yes ☐ No

6.9 Please indicate the first destination/location that will be receiving the storm water:

☐ Natural Water Body Name: _____

Has the Conservation Authority granted approval to discharge to this water body?

☐ Yes ☐ No

☐ Storm Water Management (SWM) Facility Name: _____

Certificate of Approval No. (if applicable): _____ OR,

Application Reference No. (if submitted): _____

Has the Operating Authority (of the SWM facility) granted approval to discharge to this facility?

☐ Yes ☐ No

☐ Municipal Drain

☐ Existing Sewers

7.0 SANITARY SEWERS

For Questions 7.1 to 7.3, please attach an additional sheet if necessary

7.1 Description of Proposed Sanitary Sewer(s) (including service area/development)

7.2 Description of Existing Works (in proximity to proposed works)

7.3 For each sewer, please provide the following details in the chart below (or equivalent)

STREET	FROM (street/manhole)	TO (street/manhole)	DIAMETER (mm)	ROUGHNESS

7.4 Has the Sanitary Sewer Design Sheet (or equivalent) been included with this submission? (refer to Guidance Document in Appendix B)

☐ Yes ☐ No

7.5 Please indicate which sewage types are applicable in the drainage area and list the daily design flows used in the pipe design for each type

	SEWAGE TYPE	RECOMMENDED	USED
☐	Domestic	225 - 450 L/cap/day	
☐	Hospitals	900 - 1800 L/bed/day	
☐	Schools	70 - 140 L/student/day	
☐	Trailer Parks	340 - 800 L/space/day	
☐	Infiltration	0.1 - 0.28 L/ha/s	
☐	Industrial	35 - 55 m3/ha/day	
☐	Shopping Centres	2500 - 5000 L/1000 m2/day	
☐	Hotels/Motels	150 - 225 L/bed space/day	
☐	Other		

If **USED** *sewage daily design flow does not fall within the* **RECOMMENDED** *range, please provide rationale below:*

7.6 (a) What is the full flow velocity range for all sanitary sewers in the proposed works?

_____ to _____ m/s

(b) If the full flow velocity is outside of the range of 0.6 m/s to 3.0 m/s, what measures will be employed to reduce sewage build up and/or erosion in the pipe?

7.7 It is recommended that sanitary sewers be laid at sufficient depth to receive gravity flow from basements. Are any sanitary sewers above the depth of any basements in the area?

☐ Yes ☐ No

If 'Yes', what methods will be employed to prevent sewage backup into basements?

8.0 FORCEMAINS

For Questions 8.1 to 8.3, please attach an additional sheet if necessary

8.1 Description of Proposed Forcemain(s) (including service area/development)

Proposed works include the addition a one pump to the Boulevard Road PS. The existing forcemain will not be modified.

8.2 Description of Existing Works (in proximity to proposed works)

Existing forcemain is 400mm diameter HDPE pipe 830m in length. The forcemain runs from the Boulevard Road PS to the ACME WWTP influent chamber.

8.3 For each forcemain, please provide the following details in the chart below (or equivalent)

STREET	FROM (street/manhole)	TO (street/manhole)	DIAMETER (mm)	ROUGHNESS
Boulevard Road	White Street	ACME WWTP	400mm	120

8.4 (a) Is there an existing Certificate of Approval for the pumping station associated with this forcemain?

☐ Yes ☒ No

If 'Yes', please provide the Certificate of Approval No.: _____

If 'No', please complete 8.4(b)

(b) Please provide the pumping station design elements by completing Tables 1, 2, and 3 in Appendix C Have Tables 1, 2, and 3 been included with this submission?

☒ Yes ☐ No

8.5 If this system is **not** a grinder pump system, is the minimum pipe size at least 100 mm to allow for the passage of small solids?

☒ Yes ☐ No

If 'No', please indicate below which methods will be employed to prevent a blockage in the pipe

8.6 (a) What is the velocity range for all forcemains in the proposed works?

0.9 to 1.4 m/s

(b) If the velocity falls outside of the range of 0.8 m/s to 2.5 m/s, what measures will be employed to reduce sewage build up and/or erosion in the pipe?

n/a

8.7 Have the effects of hydraulic transient been considered?

☐ Yes ☒ No

If 'Yes', please indicate the results below:

APPENDIX A - SAMPLE TEMPLATE

STORM SEWER HYDRAULIC DESIGN SHEET

Checking Date:

Site location (City) **n=** Reviewer:

Ref# **Design Storm: The Year Storm Event**

Rational Formula: Q = 2.78*CIA

Where: Q: peak flow (L/s)
C: runoff coefficient
I: rainfall intensity (mm/h)
A: area (ha)

Concentration time: $t_c = t_i + t_f$ (minute)

Where: t_i: inlet time before pipe (minute)
t_f: time of flow in pipe (minute)
t_f = L/(60V) (minute)

Manning Equation:
Qcap. = (D/1000)^2.667*(S/100)^0.5/(3.211*n)*1000 (L/s)
D: pipe size (mm)
S: slope (grade) of pipe (%)
n: roughness coefficient

			Runoff							Pipe						
Street	From	TO	Area		Section	Accum.			peak Flow	Length	Slope	N. D.	Qcap.	V		
Name			A	C	AC	AC	t_c	"I"	Q	L	S	D	(full)	(full)	t_f	Q/Qcap.
	MH/CB	MH/CB	(ha)		(ha)	(ha)	(Min.)	mm/hr	(L/s)	(m)	%	(mm)	(L/s)	(m/s)	(Min.)	

APPENDIX B - SAMPLE TEMPLATE

SANITARY SEWER DESIGN SHEET

Review Date:

Site location (City)

n=

Reviewer:

Ref#

Residential Unit average daily flow (q): L/cap.d (225~450 L/cap.d)

Unit extraneous flow (E): L/s/ha (0.1-0.28L.s.ha)

q = average daily per capita flow (L/cap.d)
I = Unit of peak extraneous flow (L/s/ha)
Q(p) = peak population flow (L/s)
Q(I) = peak extraneous flow (L/s)
Q(d) = peak design flow (L/s)

Peaking Factor:
M =1+14/(4+(P/1000)^0.5)
Q(p) = (P/1000)qM/86.4 (L/s)
Q(I) =IA (L/s); where A = Area in hectares
Q(d) = Q(p) + Q(I) (L/s)

Manning Equation:
Qcap. = (D/1000)^2.667*(S/100)^0.5/(3.211*n)*1000 (L/s)
D: pipe size (mm)
S: slope (grade) of pipe (%)
n: roughness coefficient

			Inlet Flow								Pipe					
Location			**Individual**		**Accumulative**		**Peaking**	**Pop.**	**Extran.**	**Design**	**Length**	**Size**	**Slope**	**Capacity**	**Velocity**	
Street Name	**From**	**To**	**P**	**Area**	**P**	**Area**	**Factor**	**Q(p)**	**Q(e)**	**Q(d)**	**L**	**D**	**S**	**Qcap.**	**V**	**Q(d)/Qcap**
	MH	**MH**	**(person)**	**(ha)**	**(person)**	**(ha)**	**M**	**(L/s)**	**(L/s)**	**(L/s)**	**(m)**	**(mm)**	**(%)**	**(L/s)**	**(m/s)**	

APPENDIX C

TABLE 1: SEWAGE PUMPING STATION DESIGN

Municipality: City of Anytown

Pumping Station Name: Boulevard Road Pumping Station

Designed by: A. Engineer Date: 05/06/09

DESIGN SUBJECT		UNIT	INITIAL PERIOD	10 YEAR PERIOD	20 YEAR PERIOD	ULTIMATE PERIOD
TRIBUTARY	A) Residential	ha				142.7
	B) Commercial	ha				35
	C) Industrial	ha				0
POPULATION DENSITY		Pers/ha				Not Used
POPULATION OR EQUIVALENT	A) Residential	No.				6,256
	B) Commercial	No.				5,111
	C) Industrial	No.				0
PER CAPITA FLOW		L/cap.d				360
AVERAGE FLOW		L/s				33.3
PEAK FLOW FACTOR*						2.9
PEAK DOMESTIC FLOW		L/s				97.9
INFILTRATION RATE		L/ha.s				0.2
INFILTRATION FLOW		L/s				35.2
DESIGN PEAK FLOW (INLET SEWER)		L/s				133.1
PUMPS		No.				3
PUMP DISCHAGE		L/s				2@112,1@130
FORCE MAIN DIAMETER		mm				400
VELOCITY		m/s				0.9 to 1.4

Note:

* The peak flow factor is: 1+14/(4+P^0.5), where P is designed population, in thousand.

APPENDIX C

TABLE 2: SEWAGE PUMPING STATION DESIGN

Municipality: City of Anytown

Pumping Station Name: Boulevard Road Pumping Station

Designed by: A. Engineer Date: 05/06/09

DESIGN SUBJECT		UNIT	C=120	C=130	C=140
PUMP DESIGN FLOW		L/s	130	130	130
FORCEMAIN DIAM.		mm	400	400	400
VELOCITY		m/s	0.9	0.9	0.9
FORECEMAIN LENGTH		m	830	830	830
FORCEMAIN HEAD LOSS		m	2.2	2.0	1.7
SUCTION LINE HEAD LOSS		m	0.3	0.3	0.3
DISCHAGE LINE HEAD LOSS		m	0.3	0.3	0.3
TOTAL HEAD LOSS		m	3.0	2.6	2.3
LOW WATER LEVEL WET WELL		m	171.92	172.13	173.18
HIGH WATER LEVEL WET WELL		m	173.18	173.18	173.18
FORCEMAIN END ELEVATION		m	185.92	185.92	185.92
STATIC HEAD	MAX.	m	14.0	13.8	12.7
	MIN.	m	12.7	12.7	12.7
TOTAL DANAMIC HEAD	MAX.	m	17.0	16.4	15.0
	MIN.	m	15.7	15.3	15.0

APPENDIX C

TABLE 3: INFORMATION REQUIRED FOR SEWAGE PUMPING STATIONS APPLICATIONS

Standby Power Supply

Is standby power required?

- [x] Yes
- [ ] No

If yes, what kind of standby power is available for this pumping station?

- [ ] a) Standby Generator
- [x] b) Portable Generator
- [ ] c) Additional hydro feed line

Receiving Watercourse

Will sewage be overflow/bypass any receiving watercourse?

- [ ] Yes
- [x] No

If yes, then:

a) It will be necessary to know in detail the route by which overflow/bypass flow would gain access to the watercourse?

b) The flow in the receiving watercourse at the point of overflow/bypass from the pumping station is as follows:

_____ flow in dry weather (m3/s)

_____ flow in wet weather (m3/s)

c) The nearest water intake is located on the receiving watercourse within

_____ metres of the point of entry of the overflow.

Sewage Pumping Station

a) The operating authority responsible for maintenance and operation of this pumping station is City of Anytown

b) The high level alarm is set up to relay a signal to: City monitoring station via SCADA network.

c) Between the time of activation of the high level alarm and the overflow/basement flooding, there are:

8 m3 of storage capacity available in the sewers;

150 m3 of storage capacity available in the pumping station.

d) This storage will provide:

79 minutes retention before overflow/basement flooding occurs at the average daily design flow of 33.3 L/s; and

20 minutes retention before overflow/basement flooding occurs at the peak design flow of 133.1 L/s.

e) It is possible to bypass or pump around the pumping station with portable equipment by utilizing the following procedure:

Suction end of portable pump(s) will be inserted into wet well and discharge end will be connected to bypass standpipe. Bypass standpipe is connected to the existing forcemain.

ATTACHMENT 12

DESCRIPTION OF PROPOSED AND EXISTING WORKS

It is the intent of this application to apply for an Amended C of A that includes the proposed works and modifications to the existing works described below in accordance with the Design Brief (Attachment 9). An electronic copy of this attachment has also been provided for review and use by the MOE.

PROPOSED WORKS

PUMPING STATION

- one (1) additional lift pump, rated at 130 L/s at 17.5 m TDH; and
- three (3) 250 mm magnetic flow meters.

FLOW DISTRIBUTION CHAMBER

- modification of the existing distribution chamber for distribution of screened sewage to the new secondary treatment train in addition to the existing secondary treatment train; and
- one (1) motorized weir gate and outlet pipe from the distribution chamber to the new secondary treatment train with a magnetic flow meter in a chamber.

NEW SECONDARY TREATMENT TRAIN

- two (2) 28.0 m x 6.9 m x 4.6 m SWD extended aeration tanks equipped with fine-bubble diffuser system;
- two (2) aeration blowers (one standby), each rated at 32 m^3/min and equipped with VFD;
- two (2) 20.0 m x 4.9 m x 4.5 m SWD secondary clarifiers equipped with manually operated scum removal system and motorized chain and flight sludge collection system;
- one (1) scum sump equipped with two scum pumps (one standby), each rated at 22 L/s;
- four (4) return activated sludge pumps (two per clarifier), each rated at 19.3 L/s and equipped with VFD; and
- two (2) waste activated sludge pumps (one per clarifier), each rated at 12.6 L/s and equipped with VFD.

TERTIARY FILTRATION

- one (1) baffled mixing chamber that collects flow from both the existing and new secondary treatment trains, with an alum dosing site and tertiary treatment overflow pipe;
- four (4) continuous backwash, upflow sand filtration cells, comprising the first stage of tertiary filtration, each measuring approximately 4.32 m x 2.16 m x 6 m overall depth;
- four (4) continuous backwash, upflow sand filtration cells, comprising the second stage of tertiary filtration, each measuring approximately 4.32 m x 2.16 m x 5 m overall depth;
- two (2) air compressors (one standby) for the filtration air lift systems; and
- a filter reject treatment system including filter reject pumps, gravity settler, polymer feed system, and sludge transfer pumps.

DISINFECTION SYSTEM

- two (2) disinfection channels each equipped with a UV disinfection system having a Peak Flow Rate of 11,500 m^3/d; and

- one (1) disinfected effluent automatic sampler relocated from the existing UV disinfection channel.

EFFLUENT FLOW METER

- an effluent magnetic flow meter in the new outfall pipe within the tertiary treatment building relocated from the existing effluent flow meter chamber.

PLANT OUTFALL

- one (1) 600 mm diameter outfall pipe and a headwall.

SLUDGE HANDLING SYSTEM

- two (2) polymer blending systems to deliver polymer to WAS from the new secondary treatment train and existing secondary treatment train aerobic digester;
- one (1) replacement sludge pump for the existing aerobic digester rated at 12.6 L/s to pump sludge from the existing aerobic digester to the sludge handling system;
- one (1) replacement scum pump for the existing secondary treatment train rated at 22 L/s to pump scum from the existing scum tank to the new sludge loading station or to the sludge handling system;
- two (2) 4.5 m diameter x 5.4 m overall height gravity sludge thickeners, each equipped with one (1) motorized decanted;
- one (1) 13.7 m x 7.0 m x 3.2 m SWD aerated sludge holding tank equipped with a coarse bubble diffuser system;
- two (2) aeration blowers (one standby) each rated at 10 m^3/min and equipped with VFD;
- two (2) sludge transfer pumps (one standby) each rated at 26.4 L/s to pump sludge from the holding tank to the sludge loading station; and
- one (1) sludge truck loading station for transferring sludge to another sewage treatment plant as approved by the *District Manager* for further processing.

ODOUR CONTROL SYSTEM

- one (1) influent blower with a capacity of 15.6 m^3/min to draw odourous air from existing headworks unit processes, the gravity settlers, and the sludge holding tank;
- one (1) 2.44 m diameter odour control biofilter unit containing inorganic biofilter media, with a treatment capacity of 21.24 m^3/min; and
- one (1) 200 mm diameter stack venting treated air from the odour control unit to the atmosphere.

PHOSPHORUS REMOVAL

- four (4) 20 L/h feed pumps (one standby) to supply chemical to the secondary treatment trains.

STANDBY POWER

- one (1) 750 kW standby diesel-fired generator set.

EXISTING WORKS

INFLUENT SEWER

- a 400 mm diameter influent sewer.

HEADWORKS BUILDING

- one (1) influent channel equipped with a mechanical fine screen with a Peak Flow Rate of 11,496 m^3/d;
- one (1) bypass channel equipped with a manual bar screen with 25 mm bar spacing;
- one (1) mechanical screenings dewatering press;
- two (2) vortex type grit removal tanks, each with a Peak Flow Rate of 8,633 m^3/d;
- one (1) grit dewatering press;
- two (2) positive displacement grit blowers (one standby), each rated at 120 m^3/h; and
- one (1) raw sewage automatic sampler.

INFLUENT FLOW METER

- an influent magnetic flow meter in a chamber located downstream of the headworks.

FLOW DISTRIBUTION CHAMBER

- one (1) screened sewage distribution chamber (**to be modified**).

SECONDARY TREATMENT TRAIN

- one (1) 4.0 m SWD aeration tank approximately 1,220 m^3, in the annular ring of a circular structure, equipped with coarse bubble diffused air system;
- one (1) 12.3 m diameter x 3.8 m SWD central circular clarifier with influent well, scum baffle and equipped with sludge scraping mechanism;
- a scum chamber equipped with one (1) submersible pump rated at 22.1 L/s at 7.0 m TDH;
- one (1) 4.0 m SWD two-stage sludge digestion/holding tank approximately 150 m3 in the annular ring, equipped with coarse bubble diffused air system;
- three (3) blowers each rated at 1,904 m^3/h and two (2) blowers each rated at 952 m^3/h;
- a sludge chamber equipped with one (1) submersible pump rated at 28.4 L.s at 7.0 m TDH;
- two (2) dry pit sludge pumps each rated at 27.8 L/s at 3.66 m TDH; and
- a magnetic flowmeter on the return and waste activated sludge lines.

TERTIARY FILTRATION

- three (3) continuous upflow self-cleaning deep bed single media sand filters (**to be decommissioned**);
- two (2) air compressors (**to be decommissioned**); and
- a backwash sump chamber equipped with two (2) submersible pumps, each rated at 12 L/s capacity at 8.6 m TDH (**to be decommissioned**).

DISINFECTION

- a disinfection channel equipped with a UV disinfection system comprising two (2) banks of UV lamps having a Peak Flow Rate of 4,218 m^3/d (**to be decommissioned**).

EFFLUENT SAMPLING

- one (1) effluent automatic sampler located at the UV disinfection channel upstream of level control weir (**to be relocated**).

EFFLUENT FLOW METER CHAMBER

- an effluent magnetic flow meter (**to be relocated**) in a chamber located downstream of the UV disinfection system (**to be decommissioned**).

EFFLUENT OUTFALL

- approximately 70 m of 300 mm diameter outfall sewer discharging into the Anytown River (**to be decommissioned**).

PHOSPHORUS REMOVAL SYSTEM

- one (1) 18.9 m3 capacity chemical storage tank, one (1) calibration tank; and
- two (2) chemical dosing pumps with each pump rated at 8 L/h at 400 kPa for the tertiary filters.

SLUDGE HANDLING FACILITY

- a magnetic flow meter on the sludge loading pipe.

STANDBY POWER

- one (1) 350 kW standby diesel generator set.

MISCELLANEOUS

- all other controls, electrical equipment, instrumentation, piping, valves and appurtenances essential for the proper operation of the aforementioned Proposed Works and Existing Works.

ATTACHMENT 13

PROOF OF SOURCE-WATER PROTECTION CONSULTATION

CONSULTING LTD.

123 Office Drive, Someplace, ON
Telephone: 123-555-1234
Fax: 123-555-5678

MEMORANDUM

TO File **DATE** May 5, 2009

CC Peter Protector, Anytown River Valley Source Protection Committee

FROM Jo Consultant, Consulting Ltd. JC **DOCUMENT No.** 09-7654

ACME WWTP EXPANSION: SOURCE WATER PROTECTION CONSULTATION

A meeting was held on May 1, 2009 to review the potential impacts of the expansion of the ACME Wastewater Treatment Plant (WWTP) on drinking water sources in the Anytown River Valley Source Protection Area.

As part of the province's drinking water source protection initiative, the Anytown River Valley Source Protection Committee has developed the Anytown River Valley Source Protection Plan. The plan aims to implement strategies for safeguarding the watershed's surface and groundwater sources from contamination and overuse.

Consulting Ltd. briefly outlined the details of the ACME WWTP expansion project and discussed measures taken to protect the Anytown Water Treatment Plant intake from any effects of the WWTP discharge. Construction of the expansion will also included provisions for the prevention of wastewater leakage into groundwater.

P. Protector confirmed that the proposed expansion includes all measures necessary to conform to applicable policies in the Anytown River Valley Source Protection Plan.